UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

SEP 28 2017

Ms. Paula Mesaris
Chief, Environmental Branch
Department of the Army
Tobyhanna Army Depot
11 Hap Arnold Boulevard
Tobyhanna, PA 18466-5086

Dear Ms. Mesaris:

On September 26, 2017, the U.S. Environmental Protection Agency (EPA) received the Final Fourth Five-Year Review Report for the Tobyhanna Army Depot for concurrence. The report was prepared to fulfill the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c). Consistent with CERCLA Section 121(c), Executive Order 12580 and the National Contingency Plan (NCP), EPA is responsible for reviewing remedial actions where hazardous substances, pollutants, or contaminants remain on the site and are above levels that allow for "unlimited use and unrestricted exposure" (UU/UE). EPA is also responsible for preparing a report to Congress on these reviews. EPA has reviewed this five-year review report in accordance with EPA's June 2001 guidance document, *Comprehensive Five-Year Review Guidance* (OSWER No. 9355.7-03B-P, EPA 540-R-01-007).

Pursuant to EPA's June 2001Comprehensive Five-Year Review Guidance, EPA has the final authority to make protectiveness determinations about the site. EPA will either concur with the federal agency or department's protectiveness determinations or EPA may provide independent findings.

EPA has reviewed the Final Five-Year Review Report and concurs with the Army's determination that the remedies for the following Operable Units (OUs) are protective of human health and the environment because all exposure pathways have been addressed, remedies in place are functioning as designed, no new information was identified that would question protectiveness of the remedies, and there are institutional controls in place to prevent human exposure to contamination remaining at these OUs:

- *OU1 - Areas A and B*
- *OU4 – UXO Area*
- *OU5 – Former Inactive Landfill*

While the remedy at OU5 protects human health and the environment in the long-term, EPA agrees that the Army needs to complete the following action for OU5:

Issue: The arsenic Maximum Contaminant Level (MCL) specified in the September 2000 Record of Decision as a Remedial Action Objective does not reflect the current MCL of 10 ug/l.

Recommendations: EPA recommends that an Explanation of Significant Differences be completed in FY18 to document the change in the MCL.

Furthermore, EPA has evaluated the Government Performance and Results Act (GPRA) measures for the above-listed sites and has determined their status is as follows:

Environmental Indicators

1. Human Health: Current Human Exposure Controlled

2.Groundwater Migration: Groundwater Migration Under Control

Sitewide Ready for Anticipated Use

The facility has been determined to be Sitewide Ready for Anticipated Use.

The requirement for this five-year review at Tobyhanna Army Depot was triggered by the last five-year review date of September 27, 2012. The next five-year review will be due September 27, 2022.

If you have any questions, please feel free to contact me at (215) 814-2683 or have your staff contact Lorie Baker, at (215) 814-3355.

Sincerely,

Karen Melvin, Director
Hazardous Site Cleanup Division
EPA Region III

cc: Deborah Goldblum, EPA
Matthew Argust, Tobyhanna Army Depot
Robert Lewis, PADEP

FINAL

Five-Year Review Report for

TOBYHANNA ARMY DEPOT
TOBYHANNA, PENNSYLVANIA

Prepared For:

Tobyhanna Army Depot

11 Hap Arnold Boulevard

Tobyhanna, Pennsylvania 18466

and

U.S. Army Environmental Command

2450 Connell Road, Building 2264

Fort Sam Houston, Texas 78234

September 2017

Prepared By:

U.S. Army Corps of Engineers

Buffalo District

1776 Niagara Street

Buffalo, New York 14207

Final

Fourth Five-Year Review Report

for

Operable Unit 1 (Areas A and B)

Operable Unit 4

Operable Unit 5

Tobyhanna Army Depot

Tobyhanna, Pennsylvania

September 2017

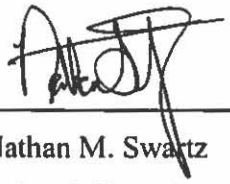
Prepared for:

Tobyhanna Army Depot

and

U.S. Army Environmental Command

Approved by: **Date:**



26SEP17

Nathan M. Swartz
Colonel, U.S. Army
Commanding

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9/6/2017

Matthew Argust
Restoration Program Manager
Tobyhanna Army Depot

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
ºC	degrees Celsius
1,2-DCP	1,2- Dichloropropane
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituents of concern
DCE	dichloroethene
DO	dissolved oxygen
DoD	Department of Defense
EA	Endangerment Assessment
EE/CA	Engineering Evaluation/Cost Assessment
EPA	Environmental Protection Agency (United States)
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	feet
FY	fiscal year
IC	institutional controls
LTM	long-term monitoring
MCL	Maximum Contaminant Level
MEC	Munitions and explosives of concern
mg/L	milligrams per liter
mm	millimeters
mV	millivolts
MNA	monitored natural attenuation
MSC	Medium Specific Concentration
NCP	National Oil and Hazard Substances Pollution Contingency Plan
NFA	no further action
NPL	National Priorities List
O&M	operations and maintenance
ORP	oxidation-reduction potential

OU	operable unit
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources
PCE	tetrachloroethene
PFAS	Per- and polyfluoroalkyl substances
PP	Proposed Plan
ppb	parts per billion
RAB	Restoration Advisory Board
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
SVOC	semi-volatile organic compound
TCE	trichloroethene
TCL	Target Compound List
TYAD	Tobyhanna Army Depot
USACE	United States Army Corps of Engineers
UU/UE	unlimited use and unrestricted exposure
UXO	unexploded ordnance
VIP	vapor intrusion pathway
VOC	volatile organic compound
yd^3	cubic yards

EXECUTIVE SUMMARY

This is the fourth five-year review of remedial actions taken at the Tobyhanna Army Depot (TYAD), which is on the National Priorities List (NPL) (U.S. EPA ID PA5213820892). In 2001, TYAD was partially delisted from the NPL. Groundwater plumes at operable units (OUs) 1 and 5 remain on the NPL.

The TYAD is located in the Pocono Mountains of Coolbaugh Township, Monroe County, Pennsylvania (Figure 1). The facility is approximately 15 miles southeast of Scranton, adjacent to the village of Tobyhanna. The facility comprises approximately 2.2 square miles (1400 acres). Today, TYAD is the largest full-service electronics maintenance facility in the Department of Defense (DoD).

This review was conducted to determine if the remedies implemented at three OUs, listed below, are and will continue to be protective of human health and the environment. The remedies at these sites do not allow for unlimited use and unrestricted exposure (UU/UE).

The following OUs are included in this review:

- OU-1 Areas A and B
- OU-4 Powder Smoke Ridge Unexploded Ordnance (UXO) Area
- OU-5 Inactive Sanitary Landfill

Table 1 describes components of the selected remedies for the OUs included in this review. Figure 2 shows the OU locations within TYAD.

Table 1. TYAD Remedies Subject to Five-Year Review

Operable Unit	Remedy
OU-1 Areas A and B	• Monitored natural attenuation • Long-term monitoring • Supply of public water to residences/businesses with wells affected by groundwater contamination • Institutional Controls (ICs) – including an agreement between Coolbaugh Township and TYAD for the Township to notify TYAD of any new construction, and prohibiting the construction of any on-post drinking water wells in the contaminant plume
OU-4 UXO Area	• ICs – including physical controls, security patrols/monitoring, UXO support, proprietary controls, and public/employee education.
OU-5 Inactive Sanitary Landfill	• Monitored natural attenuation • Long-term monitoring • ICs – including an agreement between Coolbaugh Township and TYAD for the township to notify TYAD of any new construction, prohibiting the construction of any on-post drinking water wells in the contaminant plume, ongoing public education, and presentation of groundwater monitoring results to all employees in the installation newspaper, “The Tobyhanna Reporter”.

The following data was reviewed to assess the performance of the remedies over the last five years:

- Annual Performance Evaluations
- Groundwater monitoring results for OU-1 and OU-5

Protectiveness Statements

Site-wide

The remedies at OU-1 Areas A and B, OU-4, and OU-5 are protective of human health and the environment

The remedies have been implemented and are functioning as intended by the RODs; the remedial action objectives (RAOs) are being met. ICs are preventing exposure to contaminants (OU-1 and OU-5) and unexploded ordnance (OU-4). Contaminants in groundwater at OU-1 are being reduced by natural processes.

OU-1

The remedy at OU-1 Areas A and B is protective of human health and the environment.

Soil removal reduced tetrachloroethene (PCE) and trichloroethene (TCE) concentrations to levels protective of groundwater. ICs prohibit use of contaminated groundwater and in return TYAD supplies residences and business with potable water. ICs include an agreement with Coolbaugh Township to notify TYAD of new construction involving potable water and prohibit the construction of any on-post drinking water wells in the contaminated groundwater plume. These ICs prevent contact with contaminated groundwater. Contaminant plume areas have decreased over time through natural attenuation. The maximum contaminant concentrations have been significantly reduced.

OU-4

The remedy at OU-4 is protective of human health and the environment.

ICs implemented at OU-4 prevent exposure to potential UXO through physical controls, security patrols/monitoring, UXO support, proprietary, public/employee education. The site is inspected quarterly to ensure physical controls are in good repair and are functioning as intended. In 2016, the contractor fixed broken or slack areas of the fence, cleared brush and fallen trees of the fence, and replaced any missing signs to ensure the continued function of these physical controls.

OU-5

The remedy at OU-5 is protective of human health and the environment.

ICs prevent contact with contaminated groundwater through an agreement between TYAD and the Coolbaugh Township to notify TYAD of any new construction involving potable water and prohibiting construction of any on-post drinking water well in the contaminated groundwater plume. Reduction in contaminant plume size over time has been achieved through natural attenuation.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Tobyhanna Army Depot		
EPA ID: PA5213820892		
Region: 3	**State:** PA	**City/County** Coolbaugh Township, Monroe County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** U.S. Army
Author name (Federal or State Project Manager): Matthew J. Argust
Author affiliation: Environmental Restoration Manager, TYAD
Review period: June 2016 – September 2017
Date of site inspection: 21 July 2016
Type of review: Statutory
Review number: 4
Triggering action date: 27 September 2012
Due date *(five years after triggering action date)*: 27 September 2017

Issues/Recommendations
AOC(s) without Issues/Recommendations Identified in the Five-Year Review:
OU-1, OU-4, OU-5

Protectiveness Statement(s)		
AOC: OU-1	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Not Applicable
Protectiveness Statement: The remedy at OU-1 Areas A and B is protective of human health and the environment. Soil removal reduced PCE and TCE concentrations to levels protective of groundwater. ICs prohibit use of contaminated groundwater and in return TYAD supplies residences and business with potable water. ICs include an agreement with Coolbaugh Township to notify TYAD of new construction involving potable water and prohibit the construction of any on-post drinking water wells in the contaminated groundwater plume. These ICs prevent contact with contaminated groundwater. Contaminant plume areas have decreased over time through natural attenuation. The maximum contaminant concentrations have been significantly reduced.		
AOC: OU-4	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Not Applicable
Protectiveness Statement: The remedy at OU-4 is protective of human health and the environment. ICs implemented at OU-4 prevent exposure to potential UXO through physical controls, security patrols/monitoring, UXO support, proprietary, public/employee education. The site is inspected quarterly to ensure physical controls are in good repair and are functioning as intended. In 2016, the contractor fixed broken or slack areas of the fence, cleared brush and fallen trees of the fence, and replaced any missing signs to ensure the continued function of these physical controls.		
AOC: OU-5	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Not Applicable
Protectiveness Statement: The remedy at OU-5 is protective of human health and the environment. ICs prevent contact with contaminated groundwater through an agreement between TYAD and the Coolbaugh Township to notify TYAD of any new construction involving potable water and prohibiting construction of any on-post drinking water well in the contaminated groundwater plume. Reduction in contaminant plume size over time has been achieved through natural attenuation.		
Sitewide Protectiveness Statement		
Protectiveness Determination: Protective	*Addendum Due Date (if applicable):* Not Applicable	
Protectiveness Statement:		

The remedies at OU-1 Areas A and B, OU-4, and OU-5 are protective of human health and the environment

The remedies have been implemented and are functioning as intended by the RODs; the RAOs are being met. ICs are preventing exposure to contaminants (OU-1 and OU-5) and unexploded ordnance (OU-4). Contaminants in groundwater at OU-1 are being reduced by natural processes.

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1.0 INTRODUCTION

The U.S. Army, as the lead agency, has conducted this review to determine whether remedial actions at sites on Tobyhanna Army Depot (TYAD) are and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Army prepared this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The U.S. Environmental Protection Agency (EPA) interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This review is necessary due to the presence of contaminants at the sites above levels that allow for UU/UE. TYAD is on the National Priorities List (NPL); the U.S. EPA identification number is PA5213820892.

This is the fourth five-year review of TYAD, it was conducted between June 2016 and September 2017. OUs included in the review are OU-1, OU-4, and OU-5. The remedies identified in the Record of Decision (ROD) for each OU are summarized below:

- OU-1: Natural attenuation, long-term monitoring (LTM), and institutional controls (ICs) (ESE 1997b)
- OU-4: ICs (USAEC 2000a)
- OU-5: Natural Attenuation, LTM, and ICs (USAEC 2000b).

No further action (NFA) RODs were signed for OU-2 (former polychlorinated biphenyl substation site) and OU-3 (two former hazardous waste facilities) in 1996 and review of those sites is not required. Fifty-eight additional areas of concern (AOCs) were identified and investigated and have all been formally closed out requiring NFA. These NFA determinations were documented in three AOC Closeout Documents in 1998, 1999, and 2000 (U.S. EPA, 2000). This review was triggered by the previous five-year review's signature date of 27 September 2012.

2.0 SITE CHRONOLOGY

Table 2 lists the dates of important events for the sites.

Table 2. Chronology of Site Events

Event	Date
Installation-Wide	
TYAD initiates discovery phase of the installation restoration program.	1979
TYAD is added to the NPL.	August 1990
Federal Facility Agreement (FFA) is signed between the Army and U.S. EPA to investigate environmental impacts of past and present activities at TYAD.	November 1990
NPL construction completion milestone is completed and is documented in preliminary closeout report.	September 2000
TYAD is delisted from the NPL with the exception of the groundwater plumes at OU 1 and OU 5.	2001
First five-year review is finalized.	September 2002
Second five-year review is finalized.	September 2007
Third five-year review is finalized.	September 2012
OU-1	
Area B is used for drum staging and disposal during depot construction.	1950s
Area A operations include trench excavation, waste burning, and in-place burial of ash residue.	1950s to early 1960s
Volatile organic compounds (VOCs) are discovered in on-post drinking water supply well (ON-3) and nearby residential wells; activated carbon groundwater treatment system is installed to remove VOCs from drinking water and residents were notified	1981
Groundwater sampling indicates TCE in residential wells at levels exceeding the revised 1986 maximum contaminant level (MCL) as promulgated under the Safe Drinking Water Act.	1986
The activated carbon groundwater treatment system for drinking water supply well ON-3 is replaced with an air stripper treatment system.	1989
Army installs potable waterline from TYAD to 23 affected residences/businesses.	1991
RI/FS is submitted.	December 1992

Table 2. Chronology of Site Events

Event	Date
Proposed Plan (PP) is submitted.	September 1993
U.S. Army conducts a removal action and removes approximately 2,100 cubic yards (yd^3) of VOC-contaminated soil from OU-1.	July 1995
Revised PP is submitted.	March 1997
ROD is finalized.	September 1997
Final remedial design report is issued.	December 1998
Semi-annual sampling of groundwater monitoring wells begins.	2002
Groundwater monitoring frequency changes from semi-annual to annual sampling.	May 2007
New office building is completed within Area A with sub-slab vapor barrier and passive ventilation system.	January 2011
First round of vapor intrusion pathway (VIP) sampling occurs at four residences in OU-1 plume area.	March 2011
Second round of VIP sampling occurs at four residences.	December 2011
Second office building is constructed within Area A with sub-slab vapor barrier and passive ventilation system.	April 2012
VIP study report finalized and concludes that the VIP is not a pathway of concern for residences downgradient of TYAD.	November 2012
OU-4	
Active artillery range active during World Wars I and II	1910s and 1930-1940s
Active small arms, machine gun, and pistol range active	1960s
Ordnance and explosive archives search report for the Tobyhanna Artillery Range is completed.	September 1995
Air defense facility is built on a 20-acre site. The footprint of the facility and 100 feet (ft) around the footprint were cleared of unexploded ordnance (UXO) to a depth of 4 ft.	1998
Engineering evaluation/cost analysis (EE/CA) is submitted.	April 2000
PP is submitted.	June 2000
Barbed-wire fence and warning signs are installed around the perimeter of UXO area.	June 2000
ROD is finalized.	September 2000
Final remedial action report is signed.	March 2001

Table 2. Chronology of Site Events

Event	Date
Additional barbed-wire fencing is installed from Route 423 to the top of Powder Smoke Ridge.	2003
UXO is cleared from 4-acre site down to a depth of 2 ft near the southern boundary in support of design activities for a proposed training and conference center.	May-July 2004
UXO support is required for UXO avoidance and surface removal prior to tree clearing operations.	September 2004
UXO support is required for site inspection soil sampling at ten locations.	September 2004
Additional fencing is installed under the recommendation of the Military Munitions Response Program Final Site Inspection Report to expand the perimeter of OU-4 to include 42-acres of a former artillery range fan at the southeast corner.	2005
Approximately 100 ft of damaged perimeter fence, caused by fallen trees, are repaired.	2008
To prepare for the construction of a new radar site, a subsurface UXO removal was conducted for the 8-acre Barstow radar construction area and a surface UXO clearance was conducted for the remaining 21 acres.	April-November 2008
A munitions and explosives of concern (MEC) removal action is conducted at the new Seal Beach Radar Construction Site. A subsurface MEC clearance was conducted at the 2-acre radar construction site and a surface clearance was conducted across the remaining 20 acres.	April-October 2009
A MEC surface clearance and tree/brush clearing are conducted along both sides of the perimeter fence along the northern, eastern and western boundary. All brush, saplings, and trees along the 1.75 miles of fence line are felled and chipped out to six feet on either side of the fence and to a height of 12 ft from ground.	April-May 2010
In preparation for the radar construction work, a MEC surface sweep is conducted across the entire limits of the Barstow and Seal Beach radar construction sites.	April 2010
During the preliminary earth moving operations for the Barstow and Seal Beach radar construction, UXO avoidance support was provided for the radar construction contractor because some of the excavation work is below the depth of the previous MEC removal actions. No additional MEC is located during the UXO avoidance support at either radar site.	July-October 2010

Table 2. Chronology of Site Events

Event	Date
In preparation for fence installation work at OU-4, UXO technicians conducted a MEC surface sweep across the proposed fence line perimeter of the Barstow and Seal Beach radar facilities.	August 2011
Approximately 3,000 ft of 5-strand barbed-wire fence and UXO warning signs were installed to fence off the perimeter of the two new radar sites and safeguard the radar workers.	August-September 2011
UXO support is used to move overhead powerlines to underground on Powder Smoke Ridge and to clear 0.5 acres for a Long-Range Advance Scout Surveillance System test site.	2012
OU-5	
Sanitary landfill receives wastes including plating wastes and sludge, sewage treatment plant sludge, ashes from trash burning pits, construction rubble, paints solvents, oils, sanitary wastes, and pesticide containers.	1963 to 1979
RI is submitted.	August 1997
FS is submitted.	July 2000
PP is submitted.	August 2000
ROD is finalized.	September 2000
Remedial design/interim remedial action report is submitted.	March 2001
Semi-annual sampling of groundwater monitoring wells begins.	2002
Well surface repairs are conducted for 15 landfill wells because the protective casing were damaged and concrete pads were suspended above the ground surface due to frost heave.	November 2006
Groundwater monitoring frequency changes from semi-annual to annual sampling.	May 2007
The landfill cap is penetrated by stakes for a tripod stand for electronic test equipment without authorization. The stakes are removed and the holes are tightly packed with bentonite clay chips and hydrated to seal the holes.	April 2010

3.0 BACKGROUND

3.1 LAND AND RESOURCE USE

The TYAD is located in the Pocono Mountains of Coolbaugh Township, Monroe County, Pennsylvania (Figure 1). The facility is approximately 15 miles southeast of Scranton, adjacent to the village of Tobyhanna. The facility comprises approximately 2.2 square miles (1400 acres).

The facility was initially established as Camp Summerall in 1909. The name and mission of the installation has changed throughout its history. Beginning is 1913, the U.S. Army and National Guard used the property for machine gun and field artillery training. The facility was later renamed Tobyhanna Military Reservation and used as an ambulance and tank regiment training center and an ordnance storage depot during World War I. After World War I, the facility was officially inactive until 1932 although training by Army and National Guard field artillery units was ongoing. Between 1932 and 1941 the site was used by the Civilian Conservation Corps and cadets from West Point. In 1942, the installation was reactivated as an Army/Air Force Service Unit Training Center and was used as a storage and supply area for gliders and other equipment. Use as an artillery range continued until 1946 when the facility was again deactivated.

In 1949, the Commonwealth of Pennsylvania purchased 21,000 acres of the area from the United States War Assets Administration. In 1952, approximately 1,293 acres of that land was obtained by the United States Government for depot construction. The other portion of the land remained state owned and today is largely state game lands and parks.

In 1953, the installation was designated and established as Tobyhanna Signal Depot with an assigned supply mission. In 1962, Tobyhanna Signal Depot was transferred to the United States Materiel Command and has been used for a variety of purposes. The missions included the DoD household goods movement and storage and maintenance of the Army's central file of motion pictures and distribution of audio-visual materials.

Today, TYAD is the DOD's largest full-service electronics maintenance facility. TYAD's mission is total sustainment, including design, manufacture, repair and overhaul, of electronic systems. Systems include satellite terminals, radio and radar systems, telephones, electro-optics, night vision and anti-intrusion devices, airborne surveillance equipment, navigational instruments, electronic warfare, and guidance and control systems for tactical missiles. TYAD is the DoD's recognized leader in the areas of automated test equipment, systems integration, and electronics systems downsizing.

TYAD is bordered to the north, east, and west by the Tobyhanna State Park Reserve and to the south by the Village of Tobyhanna. Land use surrounding the depot consists of a mix of light industry, residential, and recreational uses. Residential areas exist within 200 ft of the depot to the south, southeast, and east. Figure 2 presents the locations of the three OUs at TYAD included in this five-year review.

3.2 PHYSICAL CHARACTERISTICS

3.2.1 Topography and Surface Water Drainage

TYAD lies in the southern New York section, locally termed the Pocono section, of the Appalachian Plateau Physiographic Province. This area is characterized by mature glaciated plateaus of moderate relief with broad intervening lowlands. Within TYAD, the relief varies

over approximately 220 ft. The lowest elevation (1,930 ft) occurs south of Barney's Lake, while the highest elevation (2,150 ft) occurs on Powder Smoke Ridge in OU-4.

No through-flowing drainage ways exist at TYAD. Surface drainage, originating within TYAD, flows principally into Cross Keys Run, Barney's Lake, and Hummler Run. Oakes Swamp receives drainage from western and northern portions of TYAD and discharges to the north-northwest.

3.2.2 Geology

There are two predominant geologic formations found under TYAD: shallow glacial till and consolidated bedrock. The glacial till is comprised of cobbles and boulders interspersed with varying amounts of sand and clay. There is considerable variation in thickness of glacial till material and depth to the bedrock, but the average thickness of the glacial till material is approximately 20 to 30 ft. Sandstones of the Catskill Formation of the Upper Devonian age dominate the bedrock underlying TYAD. The bedrock consists of fine to medium-grained gray sandstones, which is well-indurated and quartzitic with abundant trough crossbedding.

3.2.3 Groundwater

3.2.3.1 Shallow Unconsolidated Deposits

Groundwater is present in both the glacial till and fractured bedrock aquifers. Water in the glacial till is not used as a potable water source. Groundwater in the glacial till aquifer generally flows toward the west. Since the glacial till and fractured bedrock aquifers are hydraulically linked, VOCs in glacial till groundwater can move downward into the bedrock. The presence of fractures can strongly influence the groundwater flow and VOC migration through the bedrock aquifer.

3.2.3.2 Consolidated Bedrock Aquifer

The Poplar Gap Member of the Catskill Formation, which underlies all of the study area, is the major source of domestic water supply. This aquifer has the potential for large yields from wells located on fracture traces and is suitable for industrial purposes. Historic chemical analyses of water from wells in the Catskill Formation indicate that dissolved solids concentrations average about 100 milligrams per liter. Considerable variation in well depth within the Catskill Formation is typical and is related to thickness of surficial cover, with an average depth to bedrock of 50 ft. Depth to the groundwater surface also averages 50 ft. Water in the fractured bedrock was formerly used as a water supply source by residents. Groundwater in the fractured bedrock aquifer flows in a south-southeast direction.

3.3 HISTORY OF CONTAMINATION

VOCs were first discovered at TYAD in 1981 in an on-site drinking water supply well (ON-3). In September 1987, the Army initiated a RI/FS at TYAD to determine the source of the VOCs in groundwater as well as the nature and extent of the contamination. A hazard ranking system evaluation was performed in 1989 and TYAD was added to the NPL on 30 August 1990. A comprehensive FFA was negotiated between the Army and the U.S. EPA, and it became effective on 31 January 1991. The primary purpose of the FFA was to ensure that environmental impacts associated with past disposal activities at TYAD were thoroughly investigated and appropriate CERCLA remedial action alternatives developed and implemented to protect human health and the environment.

4.0 FIVE-YEAR REVIEW PROCESS

4.1 ADMINISTRATIVE COMPONENTS

The following activities were performed in support of the five-year review:

- Potentially interested parties and the local community were notified of the start of the five-year review;
- Documents and site data were reviewed;
- A site inspection was performed; and
- Interviews were conducted with TYAD staff and regulators with insight on decisions made and activities completed at the sites.

This five-year review report was conducted and written by staff of the U.S. Army Corps of Engineers (USACE) Buffalo District:

- Laura Allen, Environmental Engineer
- Michelle Barker, FE, PMP, HTRW Regional Technical Specialist
- Karen Keil, PhD, Environmental Toxicologist
- Michael Senus, Project Manager
- James Stachowski, PE, Environmental Engineer

4.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

A public notice was published in The Scranton Times-Tribune on 3 August 2016 stating that the five-year review process had begun. Proof of publication of the notice is provided in Attachment 9.

Once finalized, the five-year review report will be made available to the public. A copy of the document will be placed in the following repository:

Pocono Mountain Public Library
5549 Memorial Blvd. (Route 611)
Coolbaugh Township Municipal Center
Tobyhanna, Pennsylvania 18466

Upon completion of the report, a public notice will be placed in The Scranton Times-Tribune to announce the availability of the final five-year review report in the document repository.

4.3 DOCUMENT REVIEW

Relevant, site-related documents were reviewed including RODs, RIs, FSs, previous five-year review reports, annual performance evaluations and other relevant studies. A complete list of documents reviewed is provided in Attachment 2.

4.4 INTERVIEWS

The USACE requested interviews from the following personnel with knowledge of remedial actions completed at the sites and decisions made:

- Matt Argust, Environmental Restoration Manager, TYAD
- Mike Parrent, Acting Chief, Environmental Branch, TYAD
- Will Craft, Pennsylvania Department of Environmental Protection (PADEP)
- Lorie Baker, NPL coordinator/RPM/SAM, U.S. EPA

- Chris Schrorer, Deputy Project Manager, EA

To date (25 May 2017), the following interview forms have been received:

- Matt Argust, Environmental Restoration Manager, TYAD
- Michael Parrent, Acting Chief, Environmental Branch, TYAD
- Lorie Baker, NPL coordinator/RPM/SAM, U.S. EPA
- Chris Schrorer, Deputy Project Manager, EA

Lorie Baker's interview noted that a private citizen had written a letter to President Obama regarding environmental issues near his property. Ms. Baker confirmed that it was determined that TYAD was not involved in any of the activities that the citizen expressed concerns about in his letter.

Matt Argust indicated that 1,1,1-TCA was historically on-site at OU-1. 1,4-dioxane was used as a stabilizer with 1,1,1-TCA. Mr. Argust confirmed that future sampling for 1,4-dioxane at OU-1 is being planned by the installation.

No information was brought to light through the interviews that indicates issues with remedy protectiveness. Information pertaining to the remedy functions is discussed on a site-by-site basis throughout the document and complete interview records are presented in Attachment 6.

5.0 OU-1 AREAS A AND B

5.1 OU-1 BACKGROUND

5.1.1 Land and Resource Use

OU-1 is located in the southeastern portion of TYAD and is comprised of two distinct areas, Areas A and B (Figure 3). Area A was actively used from the 1950s to the early 1960s as a burning and disposal area. Area B consists of a former drum staging area used for temporary storage and disposal of building materials and other wastes during construction of the existing facility.

Much of OU-1 is vacant; it consists mainly of grassy areas and forest. Two office buildings with sub-slab vapor barriers and passive ventilation systems were constructed in Area A (completed in January 2011 and April 2012) after the completion of the ROD and remedial design.

5.1.2 History of Contamination

OU-1 consists of two sites: Areas A and B as shown on Figure 3. Area A was used during the late 1950s and early 1960s for burning waste in excavated trenches and in-place burial of ash residue generated from TYAD's heating plant. Wastes present at the site included garbage, construction rubble, scrap metal, drums, and solvents.

Area B was used as a drum staging area during the construction of TYAD. Activities included temporary storage and disposal of building materials and other wastes. During the site investigation, three potential areas of contamination were identified: a large clearing near the middle of the site, a trench containing fragments of rusted drums near the western edge of the site, and a pile of debris with additional drum fragments on the ground surface near the southwestern edge of the site.

5.1.3 Initial Response

After VOCs were first discovered in well ON-3, an activated carbon groundwater treatment system was installed to remove the VOCs from the water prior to use. Additional sampling was conducted by PADEP in nearby residential wells which detected TCE and PCE. The levels did not exceed PADEP's 1981 drinking water standard for TCE (45 parts per billion [ppb]) but residents were notified of the elevated levels (ESE 1997b).

Two sampling events in 1986 conducted by the Monroe County Planning Commission and PADEP found elevated levels of VOCs. TCE concentrations exceeded the federal drinking water MCL of 5 ppb in some wells. The Army began supplying bottled water to residences affected by the elevated TCE concentrations. In 1989, the activated carbon system was replaced with a permanent air stripper at well ON-3.

Between June and July 1990, 32 yd^3 of soil were removed from Area B for a treatment study. The study concluded that passive volatilization would be an effective technology for removing TCE from soil.

An agreement between TYAD and 23 residences/businesses affected by groundwater contamination was made in June 1991. The residents agreed to stop using their wells for potable water and the Army installed a waterline from TYAD to the residences to provide continuous potable water. The residents also agreed to allow TYAD to sample water from their wells for VOCs semi-annually for monitoring purposes (ESE 1997b).

5.1.4 Basis for Taking Action

The basis for taking action at OU-1 was identified in the endangerment assessment (EA) (ESE 1989), the RI (ESE 1988), and the FS (ESE 1992). The RI identified two areas (Areas A and B) as the possible source of VOC groundwater contamination in the southeastern portion of TYAD. The EA determined that risk due to exposure to contaminated groundwater exceeded U.S. EPA guidelines. The potential exposure pathways for VOCs in groundwater were identified as ingestion, dermal contact, inhalation during non-consumptive use and inhalation from vapor intrusion. Soil remediation goals were developed to be protective of groundwater.

5.2 OU-1 REMEDIAL ACTIONS

5.2.1 Remedy Selection

The remedy for OU-1 was selected based on its ability to achieve the following RAOs:

- Minimize the potential for future migration of VOCs in groundwater; and
- Restore groundwater in the glacial till and bedrock aquifers to beneficial use and to levels protective of human health and the environment, as soon as practicable, through natural attenuation.

An interim response action objective was also provided; prevent exposure to groundwater until it has been restored to federal MCLs.

A ROD was issued in September 1997. It selected natural attenuation/LTM/ICs as the remedy for groundwater and no further action of soils (ESE 1997b).

The performance standard for the selected remedy was the remediation of constituents of concern (COCs) to MCLs throughout the entire plume of groundwater contamination. The COCs for OU-1 are PCE, TCE, and vinyl chloride. The cleanup levels (MCLs as set forth at 40 CFR § 141.61[a]) for each COC are presented in Table 3. The ROD estimated 15 years would be required to achieve the cleanup goals (or by 2012).

Natural attenuation is a process of naturally reducing contaminant concentrations in the environmental over time. Performance of the remedy was to be monitored through semi-annual groundwater monitoring of the COCs and their degradation products. The following ICs were included in the selected remedy:

- Use of groundwater from residential wells is prohibited with the exception of monitoring by the Army. In return, TYAD will supply potable water to residences/businesses that have wells with VOC concentrations in excess of MCLs. Additionally, any new residences/business within the VOC-contaminated area will be supplied with potable water;
- An agreement with Coolbaugh Township Zoning Office to notify TYAD of new construction involving potable water to ensure that new wells are not placed in areas of known or suspected contamination and allow the residents to be connected to the TYAD potable water supply; and
- Prohibiting the construction of any on-post drinking water wells in the contaminated groundwater plume.

LTM and ICs will continue to be administered until U.S. EPA and the Army, in consultation with PADEP, determine that the performance standard has been achieved throughout the entire plume of groundwater contamination.

Table 3. OU-1 Groundwater Cleanup Levels

COC	Cleanup Level (µg/L)
PCE	5
TCE	5
Vinyl chloride	2

Notes:
PCE tetrachloroethene
TCE trichloroethene
µg/L micrograms per liter

5.2.2 Remedy Implementation

The implemented remedial action at OU-1 Areas A and B is described in the Final Remedial Action Report (U.S. EPA 2001a). Groundwater monitoring was performed in accordance with the *Final Remedial Design Report for Operable Unit 1* (WESTON 1998). Groundwater samples were collected twice per year and analyzed for VOCs using U.S. EPA Method 8260B. The sampling frequency was decreased to once per year in 2007 by agreement with U.S. EPA and PADEP. To date, nineteen rounds of semi-annual and ten rounds of annual sampling have been conducted under the LTM requirements of the ROD beginning in 1997.

ICs were implemented at TYAD as described in the ROD to prevent human consumption of contaminated groundwater while natural attenuation is ongoing. The ICs that required TYAD to supply potable water to affected residences/businesses and Coolbaugh Township to notify TYAD of new potable water well construction were implemented prior to the ROD. The IC that prohibited construction of new on-post drinking water wells in the contaminated groundwater plume was incorporated into the TYAD Master Plan (U.S. EPA 2001a). Letters documenting IC agreements are provided in Attachment 11.

The remedy will continue until the U.S. EPA and the Army, in consultation with PADEP, determine that the performance standard has been achieved. The ROD estimated that the cleanup goals would be achieved by September 2012.

Construction of office building within Area A (along Corporal Damato Street) began in 2010 with the first building completed in January 2011 and the second completed in April 2012. Due to the potential of vapor intrusion issues related to the VOC concentrations in groundwater, the buildings' construction included sub-slab vapor barriers and passive vapor ventilation systems. Any proposed construction in the area is reviewed by the environmental branch so that appropriate vapor intrusion controls may be implemented.

A VIP study was completed in November 2012 to determine if the VIP poses an indoor air quality risk to human health to residents downgradient of Area B. The study was conducted to determine whether TCE, PCE, and their breakdown products are exceeding U.S. EPA/PADEP soil gas and indoor air screening levels. Sampling was conducted at four residences that surround a monitoring well that had the highest reported concentrations of PCE and TCE (MW23). Indoor air, ambient air, and sump water were collected from the basement and first

floors of the homes in March and December 2011. TCE was detected in the indoor air sample from one residence at a concentration exceeding the screening level. A third round of sampling was conducted at that residence in August 2012 and no COCs were detected in the indoor air. The Army concluded that the TCE screening level exceedance was not a result of the bedrock groundwater contamination associated with OU-1 and the VIP is not a pathway of concern for these residences (WESTON 2012b). U.S. EPA concurred with this assessment in an Addendum to the Third Five-Year Review Report (TYAD and U.S. EPA 2013).

5.2.3 Maintenance and Monitoring

Long term monitoring includes collection of groundwater samples, chemical analysis, water level measurements, and preparing groundwater monitoring reports. Operations and maintenance (O&M) activities include evaluation of monitoring and water supply wells and off-post well pump systems.

Groundwater monitoring was performed semi-annually until 2007, when the frequency was reduced to annually. Samples are analyzed for target compound list (TCL) VOCs. The most recent groundwater sampling event occurred from 19 to 22 October 2015. Monitoring well sampled are listed below and shown on Figure 3.

<u>On-Post Monitoring Wells</u>

- MW01, Bedrock aquifer
- MW05, Bedrock aquifer
- MW11, Glacial till aquifer
- MW12, Glacial till aquifer
- MW13, Glacial till aquifer
- MW14, Bedrock aquifer
- MW21, Bedrock aquifer

<u>Off-Post Monitoring Well</u>

- MW23, Bedrock aquifer

<u>Off-Post Residential Wells</u>

- R1-82, Bedrock aquifer (not sampled during October 2015 event)
- R1-102, Bedrock aquifer
- R1-103, Bedrock aquifer
- R1-105, Bedrock aquifer (not sampled during October 2015 event)
- R1-109, Bedrock aquifer
- R1-110, Bedrock aquifer
- R1-110-2, Bedrock aquifer
- R1-111, Bedrock aquifer
- R1-116, Bedrock aquifer
- R2-15, Bedrock aquifer (not sampled during October 2015 event)
- R2-23, Bedrock aquifer

<u>On-post Supply Well</u>

- ON-3, Bedrock aquifer (not sampled during October 2015 event)

TYAD inspects the site monthly to address any maintenance concerns. Since the completion of last five-year review, required maintenance has included the repair of soil vapor extraction system monometers in building 1A and repairing off-post monitoring well caps.

5.3 OU-1 PROGRESS SINCE LAST REVIEW

The third five-year review (WESTON 2012a) included the following protectiveness statement for OU-1 Areas A and B:

> "The remedy at OU-1 (Natural Attenuation/Long-Term Monitoring/Institutional Controls) is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled."

In a letter to the Army dated September 25, 2012, U.S. EPA issued a separate protectiveness statement for the remedy at OU-1:

> "The remedy at OU-1 is protective in the short term; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken.
>
> The Protectiveness Statement for OU-1 was deemed to be protective in the short term due to inconclusive results of a vapor intrusion investigation. During the second round of sampling of the vapor intrusion investigation, TCE was detected in the first floor of a residential home, identified as R1-111 at a concentration of 52 µg/m³. This exceeds both the Regional Screening Level (RSL) of 0.43 µg/m³ and Pennsylvania's Medium Specific Concentration (MSC) for Indoor Air Quality of 12 µg/m³. This was the only sample from the vapor intrusion investigation where contaminants were detected above the RSL or MSC. Neither the basement nor the first floor were found to have levels above the MSC or RSL in the first round. During the second round, the basement was also below the RSL/MSC. Although it appeared likely that the high concentration found in the first floor during the second round was from a household source, the EPA determined that the protectiveness statement could not be considered "protective" until this residence was resampled. The EPA and TYAD agreed to conduct additional sampling to determine if TCE found in R1-111 was due to vapor intrusion from groundwater contaminants or from a household source."

Additional VIP sampling was conducted at structure R1-111 on 20 September 2012. No contaminants were found at concentrations exceeding screening levels. TYAD and the U.S. EPA agreed that TCE detected in R1-111 during the second round of sampling was from a household source and not from groundwater contaminants and that vapor intrusion is not a concern for the residents near TYAD. The U.S. EPA concurred with TYAD's recommendation that the vapor intrusion investigation be closed with no further action.

Based on the conclusion of the additional vapor intrusion sampling, completed after the five year review completion date, the protectiveness statement was revised in the addendum to the third five year review as follows:

> "The remedy at OU-1 remains protective of human health and the environment."

5.3.1 Issues Identified during the Last Five-Year Review at OU-1

Five issues were identified in the third Five-Year Review that may affect the future protectiveness of the remedy at OU-1 (WESTON 2012a). These issues, their corresponding recommendations/follow-up actions, and their current status are summarized in Table 4.

Table 4. Issues Identified during the Last Five-Year Review at OU-1

Issues	Recommendations	Status
Rights of entry for property R1-94. TYAD needs to re-establish rights of entry for property R1-94 with the new owners. This is a critical sampling property required to develop complete and accurate contaminant plume maps.	Re-establish rights of entry for property R1-94 with the new owners. (Fall 2012 milestone date)	Monitoring well R1-94 has not been sampled since the November 2009 event. The property is no longer advertised as for sale but it has not been determined if the property was sold or removed from the market. If the property has been sold, TYAD will attempt to reestablish a right of entry when the new owner contacts TYAD to be added to the waterline.
Vapor intrusion study. The vapor sampling and draft report have recently been completed and the *Draft Vapor Intrusion Pathway Study Report for Tobyhanna Operable Unit 1* is currently under review by PADEP and EPA. Any issues identified by EPA and PADEP will need to be resolved.	Finalize the *Vapor Intrusion Pathway Study Report for Tobyhanna Operable Unit 1* (Third or fourth quarter 2012 milestone date)	The report was finalized in November 2012. It concluded that "the detection at levels exceeding screening levels of TCE in indoor and ambient air at these residences are not a result of the bedrock groundwater contamination associated with OU-1 at TYAD, and that the vapor intrusion pathway is not a pathway of concern for these residences" (WESTON 2012b).
Residential vapor sample at property R1-111. During the second round of vapor sampling there was a detection of TCE on the first floor of one of the residences. This first floor location should be re-sampled to confirm the detection and verify that the detected levels of TCE were the result of a household source.	Resample the first floor of one residential location due to an elevated TCE reading in one of the indoor air samples. (Third or fourth quarter 2012 milestone date)	An additional round of sampling was conducted at R1-111 on 20 September 2012. No contaminants were found. It was agreed upon by U.S. EPA and PADEP that detection of TCE during the second round of vapor intrusion sampling was due to a household source. It was concluded that vapor intrusion is not a concern for the residents near TYAD.
Exit strategy for groundwater monitoring. A clear, well-defined exit strategy for groundwater monitoring at OU-1 has not been developed. There are no criteria for demonstrating that the COCs have permanently	Develop Exit Strategy as part of the upcoming Annual Performance Evaluations for the remedy for OU-1.	An exit strategy for OU-1 has not been defined in Annual Performance Evaluations that have been published since the completion of the third five year review (WESTON 2013, 2014; EA 2016a, 2016b). Matt Argust,

decreased to concentrations less than the performance standards for the remedial actions. The MNA [monitored natural attenuation] remedy for OU-1 should be re-evaluated before the next five year review as part of the Annual Performance Evaluations.	(First quarter 2014 milestone date)	Environmental Restoration Manager, indicated that an exit strategy will be included in the 2017 Annual Performance Evaluation.
Re-evaluate MNA remedy. It has been 15 years since the MNA remedy was selected and the RAOs have not been achieved. The MNA remedy for OU-1 should be re-evaluated before the next Five-Year Review as part of the Annual Performance Evaluations.	Re-evaluate the MNA remedy for OU-1 in conjunction with the upcoming Annual Performance Evaluations. (September 2017 milestone date)	The remedy remains as defined under the ROD. Matt Argust, Environmental Restoration Manager, indicated during his interview that the remedy has been re-evaluated and the results will be presented in the 2017 Annual Performance Evaluation.

5.4 OU-1 SITE INSPECTION

The site inspection for OU-1 occurred on 21 July 2016. No issues affecting the protectiveness of the remedies were documented during the site inspection.

The site inspection forms and photographs taken during the site inspection are included in Attachments 4 and 5.

Observations made at OU-1 during the site inspection include:

- OU-1 Areas A and B are located inside a secure U.S. Army installation that is surrounded by a fence and access is controlled;
- Two new office buildings were constructed in Area A after the ROD and Remedial Design were complete. The buildings were constructed with sub-slab vapor barriers and passive ventilation systems;
- Areas A and B are predominately grass covered, vacant areas with a baseball diamond contained in Area A; and
- Area A is surrounded by wooded areas, roads, and new buildings and Area B is surrounded by wooded areas and a Directorate of Public Works storage facility.

5.5 OU-1 DATA REVIEW

Recent groundwater data is presented in the *Draft Final 2015 Annual Performance Evaluation for Operable Units 1, 4, and 5* (EA 2016b). Attachment 10 includes recent and historic groundwater data and interpretations from the performance evaluation report.

- Figure 2-2 illustrates groundwater elevation contours and flow direction in the bedrock aquifer
- Table 2-3 presents October 2015 VOCs data
- Table 2-4 presents historical TCE data

- Table 2-5 presents historical PCE data
- Table A10-1 presents historical cis-1,2-DCE (dichloroethene) data
- Table A10-2 presents historical trans-1,2-DCE data
- Figure A10-1 illustrates the PCE plume in the bedrock aquifer from October 1998 to October 2015
- Table 2-8 presents the area of PCE bedrock groundwater plumes as a function of time
- Figure A10-2 illustrates the TCE plume in the bedrock aquifer from October 1998 to October 2015
- Table 2-7 presents the area of TCE bedrock groundwater plumes as a function of time
- Figure 2-5 is a graphical presentation of the PCE and TCE plume areas over time
- Table 2-6 presents the number of wells exceeding MCLs over time

Results and interpretations are discussed below.

Groundwater Flow

According to the 2015 Annual Performance Evaluation Report (EA 2016b), groundwater from Area A has not migrated beyond the TYAD boundary and contaminated groundwater from Area B has migrated off-site. Groundwater in the bedrock aquifer flows southeast under the Village of Tobyhanna toward MW23. Groundwater in the glacial till at Area B flows westward, away from the residential area.

Groundwater Quality

Of the 17 wells sampled in 2015, only one exhibited a cleanup level exceedance. The PCE cleanup level (5 µg/L) was exceeded in MW11 (14 µg/L). The highest PCE and TCE concentrations in bedrock occur at MW23, which is outside of Area B. During the first sampling event in 1987, 23 wells exhibited cleanup level exceedances. The maximum number of wells with exceedances after remedy implementation was 14 in the fall of 2010. Table 2-6 (Attachment 10) shows the number of wells exceeding MCLs for each sampling event. The decrease in number of wells exceeding MCLs shows reduction in contaminants on a site wide basis.

Figure A10-1, Figure A10-2, and Figure 2-5 (Attachment 10) show that the extent of PCE and TCE contaminated groundwater in bedrock has decreased over time. Tables 2-7 and 2-8 show the area of the bedrock groundwater plumes for TCE and PCE as a function of time. The 5µg/L PCE plume has not been present since April 2004 with the exception of 2009 when a PCE concentration of 5.20µg/L was detected at MW23. The 5µg/L PCE plume area has been reduced to zero percent of the original plume and the 1µg/L PCE plume had been reduced to 37 percent of the original plume area. The 5µg/L TCE plume has been decreasing overall since October 2004 with no detections above the MCL reported in July or October 2015. The 5µg/L TCE plume has been reduced to zero percent of the original plume area. The 1µg/L TCE plume has been reduced to 21 percent of the original plume area.

This five-year review analyzed PCE and TCE concentration trends using the Normal Approximation Mann-Kendall Test and the Small-Sample Mann-Kendall Test for Trend for data sets with a sample size less than ten. The trends were evaluated using data from April 2004 to October 2015, when low-flow sampling was used. The trend analysis was conducted using a 95 percent confidence level. Time series plots and Mann-Kendall test results are included in

Attachment 10. The results are also summarized in Table 5, which indicates that decreasing or no trends were observed.

The 2015 Annual Performance Evaluation report asserts that the absence of increasing trends indicates that the 1995 soil removal action positively affected site conditions by removing the source of groundwater contamination.

The groundwater monitoring data including the number of wells above MCLs, plume areas over time, and COC concentration trends show reduction in contaminants at the site. With the exception of MW11, the groundwater RAO has been met at the site. However, the project has not established a defensible exit strategy for the site as a whole or individual wells.

Geochemistry

The OU-1 remedy includes natural attenuation of chlorinated solvents. Prior to implementing the remedy, the PP noted that the areal extent of contaminated groundwater was decreasing and contaminant levels were declining. This was interpreted to indicate that the contaminants in groundwater were attenuating by natural processes (ESE 1997a).

Water quality parameters monitored during sampling include temperature, pH, total dissolved solids, oxidation-reduction potential (ORP), conductivity, salinity, dissolved oxygen (DO), and turbidity measured in a flow-through cell. The DO, ORP, and pH measurements were evaluated in this five-year review to determine if conditions suitable for natural attenuation are present. The data is presented in Attachment 10 Table A10-3. The data were screened against the following guidelines:

- DO – concentrations less than 0.5 milligrams per liter (mg/L) are tolerated. Higher concentrations suppress the reductive pathway. Concentrations greater than 5 mg/L are not tolerated.
- ORP – A reductive pathway is possible if the ORP is less than 50 millivolts (mV). A reductive pathway is likely if the ORP is less than -100 mV
- pH – The optimal range for reductive pathway is between 5 and 9

All wells purged to stable conditions (October 2015) exhibited the following results:

- DO concentrations between 0 mg/L and 3.8 mg/L
- ORP between 6 and 270 mV
- pH was within the optimal range for all wells except MW21 (11.46). Compared to other bedrock wells, this result is an anomaly and not considered valid.

Based on these results, the geochemical conditions at OU-1 are marginally suitable for anaerobic reductive dechlorination. Natural attenuation parameters including methane, ethane/ethene, nitrate, ferrous iron, and total organic carbon should be collected and reported during the next groundwater sampling event. These results can be used to more fully assess the subsurface geochemical conditions at OU-1.

Table 5. Summary of Mann-Kendall Trend Analysis for Groundwater Sampling at OU-1

Well	Zone Monitored	COC		Comments
		PCE	TCE	
OU-1				
On-Post				
MW01	Bedrock	NE	D	Area A well. PCE never detected above site cleanup level (SCL), TCE not detected above SCL since November 2009.
MW05	Bedrock	NE	D	PCE and TCE never detected above SCL.
MW11	Glacial till	NT	D	Area B well. PCE detected above SCL in all samples, TCE not detected above SCL since November 2010.
MW12	Glacial till	NT	NE	Area B well. PCE and TCE never detected above SCL.
MW13	Glacial till	NT	NT	Area B well. PCE not detected above SCL since November 2010, TCE not detected above SCL since October 2012.
MW14	Bedrock	NT	NT	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since December 2008.
MW21	Bedrock	D	D	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since November 2010.
ON03	Bedrock	NE	NT	PCE and TCE never detected above SCL.
Off-Post				
MW23	Bedrock	D	D	PCE not detected above SCL since November 2009, TCE not detected above SCL since October 2013.
R1-102	Bedrock	D	D	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since October 2013.
R1-103	Bedrock	D	D	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since November 2009.
R1-105	Bedrock	NT	NT	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since October 2012.
R1-109	Bedrock	D	NT	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since November 2010.
R1-110	Bedrock	NT	D	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since October 2006.
R1-110-2	Bedrock	D	D	PCE never detected above site cleanup level (SCL), TCE not detected above SCL since October 2006.

R1-111	Bedrock	NE	D	PCE and TCE never detected above SCLs.

Notes:

D Downward trend
NE Not evaluated
NT No trend
U Upward trend
--- Parameter not analyzed

5.6 OU-1 TECHNICAL ASSESSMENT

5.6.1 Question A:

Is the Remedy Functioning as Intended by the Decision Document?

Yes, the remedy is functioning as intended by the decision document; however, it has not completely achieved the cleanup goals in the time frame estimated in the ROD and an appropriate exit strategy has not been established. The information supporting this response is summarized below relative to the RAOs established in the OU-1 ROD:

- Minimize the potential for future migration of VOCs in groundwater.

  The pre-ROD contaminated soils removal action at Area B in 1995 minimized future releases to groundwater. The absence of increasing PCE and TCE trends indicates that further contamination is not being released into the groundwater. This RAO has been meet.

- Restore groundwater in glacial till and bedrock aquifers to beneficial use and to levels that are protective of human health and the environment.

  The size and concentration of PCE and TCE contaminant plumes in bedrock have decreased in size over time and only one cleanup level exceedance was reported during the 2015 monitoring event.

- Prevent exposure to groundwater until it has been restored to Federal MCLs.

  The remedy includes ICs that prevent exposure to groundwater including TYAD providing potable water to affected residences/businesses so that affected residential wells are not for any purpose except for monitoring, an agreement with the Coolbaugh Township Zoning Office to notify TYAD of any new construction involving potable water, and prohibiting the construction of on-post drinking water wells in the contaminated groundwater plume. Site inspection observations indicate that no new potable water wells have been installed in accordance with ICs. This RAO has been achieved.

This five-year review has not identified any early indicators of potential remedy problems.

5.6.2 Question B:

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid?

Yes, the cleanup levels and RAOs used at the time of the remedy are still valid. The ARAR evaluation (Attachment 7) determined there are no newly promulgated or modified requirements of federal or state environmental laws that would change the protectiveness of the remedy. As evaluated in the risk assessment and toxicology review (Attachment 8), some COCs have had toxicity criteria changes, however, the ARAR-based cleanup goals for the COCs still afford an acceptable level of risk (remain protective).

The Army continues to supply drinking water to affected residences and businesses. Vapor intrusion risks to off-site residents were evaluated in 2012 and the vapor intrusion pathway study conclusions, indicating that this pathway does not pose a risk, remain valid. No exposure to ecological receptors is expected.

5.6.3 Question C:

Has any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

1,4-dioxane has been identified as an possible emerging contaminant due to the historic use of 1,1,1-TCA on-site. 1,4-dioxane was used as a stabilizer with 1,1,1-TCA. The potential presence of 1,4-dioxane should be evaluated. The installation has stated future plans for 1,4-dioxane sampling at the CERCLA monitoring wells and in the drinking water aquifer.

There are no new ecological risks because that land use remains commercial/industrial or residential. There have been no impacts from natural disasters.

5.6.4 Summary

The remedy is functioning as intended by the ROD. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection are still valid. There are no newly promulgated or modified requirements of federal or state environmental laws that would change the protectiveness of the remedy. No other information has come to light that could call into question the protectiveness of the remedy.

5.7 OU-1 ISSUES

No issues affecting protectiveness were identified at OU-1.

5.8 OU-1 RECOMMENDATIONS AND OTHER FINDINGS

5.8.1 Recommendations

There are no recommendations for issues that affect protectiveness.

5.8.2 Other Findings

Table 6 summarizes other findings and recommendations for OU-1 which do not affect site protectiveness.

Table 6. Other Findings and Recommendations at TYAD OU-1

Findings	Recommendations
Site cleanup goals have not been attained within the 15 year time frame estimated in the ROD.	Natural attenuation parameters including methane, ethane/ethene, nitrate, ferrous iron, and total organic carbon should be collected and reported during the next groundwater sampling event. The results should be used to re-evaluate the remedy performance as part of the upcoming Annual Performance Review prior to the start of the next five-year review.
The project has not established a well-defined exit strategy.	An exit strategy for the site should be developed using a valid statistical approach for demonstrating compliance with the MCLs (e.g. require the 95 percent upper confidence limit of the mean to be less than the MCL). An exit strategy should also be defined for individual wells

Findings	Recommendations
	that have meet RAOs to optimize the monitoring network using the U.S. EPA guidance, *Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well* (U.S. EPA, 2014).
1,4-dioxane has been identified as an possible emerging contaminant due to the historic use of 1,1,1-TCA on-site. 1,4-dioxane was used as a stabilizer with 1,1,1-TCA.	The potential presence of 1,4-dioxane should be evaluated. The installation should continue with plans for 1,4-dioxane sampling at the CERCLA monitoring wells and in the drinking water aquifer.

5.9 OU-1 PROTECTIVENESS STATEMENT

The remedy at OU-1 Areas A and B is protective of human health and the environment.

Soil removal reduced PCE and TCE concentrations to levels protective of groundwater. ICs prohibit use of contaminated groundwater and in return TYAD supplies residences and business with potable water. ICs include an agreement with Coolbaugh Township to notify TYAD of new construction involving potable water and prohibit the construction of any on-post drinking water wells in the contaminated groundwater plume. These ICs prevent contact with contaminated groundwater. Contaminant plume areas have decreased over time through natural attenuation. The maximum contaminant concentrations have been significantly reduced.

6.0 OU-4 UXO AREA

6.1 OU-4 BACKGROUND

6.1.1 Land and Resource Use

OU-4 is an approximately 400-acre portion of the original artillery range that is contained within the current depot boundary. It is also known as AOC #55. The original artillery range consisted of firing points and impact areas covering approximately 21,100 acres. The remainder of the former artillery range is currently divided into Pennsylvania State Parks, Pennsylvania Game Commission land, and Coolbaugh Township Municipal Park. This portion of land is addressed separately under the Formerly Used Defense Site program.

Currently, radar facilities are located within OU-4 with workers actively present. Figure 4 shows the site features.

6.1.2 History of Contamination

OU-4 is located within the former Tobyhanna Artillery Range which was used for artillery practice and machine gun training by the Army and National Guard from 1912 until 1949. The artillery range mainly received 37 and 75-millimeter (mm) ammunition fire from two fire points, one on the southwest end of the depot and one on the northwest side of the depot. Neither firing point is located within OU-4. Other UXO identified in OU-4 includes 155-mm, 3-pounder naval common and 60-mm mortar projectiles, plus white phosphorous and smoke grenades.

6.1.3 Initial Response

The Army cleared approximately 20 acres of land within the area in 1998 for construction of a radar facility. The footprint of the facility and 100 ft surrounding the fence line were cleared to a depth of 4 ft. The rest of the construction area was cleared to a depth of 1 ft.

In August 2000, a pre-ROD removal action was completed including installation of a barbed wire fence and warning signs along the perimeter of the UXO area to prevent unauthorized personnel from entering the area and accidently coming in contact with UXO (USAEC 2000a).

6.1.4 Basis for Taking Action

The basis for taking action at the UXO area on Powder Smoke Ridge was identified in an ordnance and explosive archives search (USACE 1995) and an EE/CA (PMC 2000a) of the area. The ordnance and explosives archives search characterized the site for potential contamination through evaluation of historical records, interviews, and on-site visual inspections. A risk assessment was completed as part of the archives search and evaluated OU-4 in the EE/CA. The assessment consists of two factors, hazard severity and hazard probability. The total hazard severity value for the UXO area was 20, which is a Category II or Critical hazard. Total hazard probability value for the area was 24, which is a Level B or Probable hazard. These two scores were combined to obtain a Risk Assessment Code of 2 for OU-4. This Risk Assessment Code indicated a high priority site where further action was recommended.

6.2 OU-4 REMEDIAL ACTIONS

6.2.1 Remedy Selection

RAOs were developed as basic requirements the selected remedy for OU-4 should meet. They were defined in the ROD (USAEC 2000a) as:

- Reduce potential exposure to UXO by on-site workers or trespassers;
- Ensure that proper UXO clearance procedures are followed if or when any portion of this area is to be developed by the Army in the future;
- Restrict future uses of the land; and
- Educate the public/employees on the dangers of UXO at AOC #55 (OU-4).

The OU-4 ROD was issued in September 2000 and described the selected remedy for the UXO area of TYAD (USAEC 2000a). The remedy was selected to meet the RAOs as well as comply with CERCLA. The selected remedy was ICs, which included the following elements as defined in the ROD:

- Physical controls – Maintenance of the barbed-wire fence and signs posted around the perimeter of OU-4;
- Security Patrols/Monitoring – Increased security patrols to minimize the number of willful trespassers onto OU-4, especially during periods of increased pedestrian activity (e.g. hunting season);
- UXO Support – Use of Explosives Ordnance Disposal trained personnel to provide support in the case that any future intrusive activities by the Army take place within OU-4. This requirement will be incorporated into the base Master Plan;
- Proprietary Controls – Deed restrictions on the land if it is ever transferred outside the government; and
- Public/Employee Education – Informing the public and TYAD employees of the dangers of contact with potential UXO.

Because the remedy results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for UU/UE, statutory reviews will be conducted every five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

6.2.2 Remedy Implementation

The final remedial action report for OU-4 describes ICs implemented at the UXO area (U.S. EPA 2001b). The report states that the ICs include physical controls, security patrols/monitoring, UXO support, proprietary controls, and public/employee education.

Physical controls include the pre-ROD removal action involving the construction of a barbed wire fence with warning signs around the perimeter of OU-4 in August 2000. An additional 3,000 ft of barbed wire fence was installed in September 2011 to surround newly constructed radar facilities. The fence includes UXO hazard signs on every other fence post (16 ft apart).

Security patrols and monitoring began on 1 October 2000. OU-4 is regularly patrolled by the TYAD Security Branch with increased patrols during hunting seasons due to the increased potential for trespassing. The TYAD Environmental Branch inspects OU-4 as part of the division's AOC monitoring plan.

UXO support is available from Army explosive ordnance disposal-trained personnel. Clearance procedures are followed for areas where future development is to occur. Since the last Five-Year Review UXO support was utilized twice. In 2012, UXO support was utilized to support a project to move overhead power lines underground on Powder Smoke Ridge and to clear approximately 0.5 acres of land (WESTON 2013).

As a proprietary control, deed restrictions will be placed on the land if the property is sold or transferred outside of the government. There are no plans for the property to be sold/transferred at this time.

Public and employee education was implemented through a restoration advisory board (RAB), which was established in June 1994. Public interest diminished over time and the RAB was adjourned by vote on 19 October 2005. Access to OU-4 is permitted on official business only and all persons are required to view a UXO safety video before they are allowed on the site (EA 2016b).

6.2.3 Maintenance and Monitoring

Monitoring and maintenance activities at OU-4 include monitoring and maintenance of the barbed-wire fence and signs on the perimeter of the site (U.S. EPA 2001b). The fence location is shown on Figure 4.

Since the last five-year review, the barbed-wire fence and signs around the perimeter of OU-4 have been maintained on an annual basis. An inspection of the perimeter fence was conducted in June 2015. At that time, it was recommended that vegetation clearing, reflective cord replacement, and fence repair be completed. These repairs were conducted in August and November 2015 (EA 2016b). In 2016, the contractor inspected the entire fence line, fixed broken or slack areas of the fence, and replaced any missing signs.

6.3 OU-4 Progress Since Last Five-Year Review

The third five-year review (WESTON 2012a) included the following protectiveness statement for OU-4, The UXO Area:

> "The remedy at OU-4 (Institutional Controls) is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled."

6.3.1 Issues Identified during the Last-Five Year Review at OU-4

No issues were identified by the third Five-Year Review pertaining to OU-4 (WESTON 2012a).

6.4 OU-4 Site Inspection

The site inspection for OU-4 occurred on 21 July 2016. No issues affecting the protectiveness of the remedies were documented during the site inspection.

The site inspection forms and photographs taken during the site inspection are included in Attachments 4 and 5.

Observations made at OU-4 during the site inspection include:

- OU-4 is surrounded by a five-strand barbed wire fence and interior security fences are present along roads and radar sites to prevent access to areas that have not been cleared of UXO;
- Minor damage to perimeter barbed wire fence from fallen tree limbs was observed on the eastern boundary of OU-4;
- Signs were located uniformly on the perimeter fence reading "Danger Unexploded Ordnance Explosives KEEP OUT"; and

- Area is predominately undeveloped forest with radar installations and water tanks present.

6.5 OU-4 DATA REVIEW

There are no data collection requirements required by the OU-4 ROD.

6.6 OU-4 TECHNICAL ASSESSMENT

6.6.1 Question A:

Is the Remedy Functioning as Intended by the Decision Document?

Yes, the remedy is functioning as intended by the decision document. It was intended to: 1) reduce potential exposure to unexploded ordnance (UXO) by on-site workers or trespassers, 2) ensure that proper UXO clearance procedures are followed if or when the area is to be developed by the Army in the future, 3) restrict future uses of the land, and 4) educate the public employees on the dangers of UXO at OU-4. The remedy consists of ICs, which include physical controls, security patrols/monitoring, UXO support, proprietary controls, public/employee education, and periodic (five-year) review.

Site inspection observations indicate that perimeter and interior fences and signs are maintained and routinely patrolled to reduce the potential for exposure to UXO. Clearance procedures are followed for areas where future development is to occur. TYAD implements UXO safety training for new employees and visitors. It consists of a 15 minute UXO safety video and UXO safety pamphlet. No indicators of potential remedy problems were identified.

6.6.2 Question B:

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid?

The exposure assumptions and RAOs developed at the time of the remedy are still valid at OU-4. People are prevented from encountering UXO by the perimeter fence.

6.6.3 Question C:

Is the Remedy Functioning as Intended by the Decision Document?

No other information has come to light that could call into question the protectiveness of the remedy.

6.6.4 Summary

The remedy is functioning as intended by the ROD. The exposure assumptions and RAOs used at the time of the remedy selection are still valid. No other information has come to light that could call into question the protectiveness of the remedy.

6.7 OU-4 ISSUES

No issues affecting protectiveness were identified at OU-4.

6.8 OU-4 RECOMMENDATIONS AND OTHER FINDINGS

6.8.1 Recommendations

There are no recommendations for issues that affect protectiveness.

6.8.2 Other Findings

No other findings were noted for OU-4.

6.9 OU-4 PROTECTIVENESS STATEMENT

The remedy at OU-4 is protective of human health and the environment.

ICs implemented at OU-4 prevent exposure to potential UXO through physical controls, security patrols/monitoring, UXO support, proprietary, public/employee education. The site is inspected quarterly to ensure physical controls are in good repair and are functioning as intended. In 2016, the contractor fixed broken or slack areas of the fence, cleared brush and fallen trees of the fence, and replaced any missing signs to ensure the continued function of these physical controls.

7.0 OU-5 INACTIVE SANITARY LANDFILL

7.1 OU-5 BACKGROUND

7.1.1 Land and Resource Use

OU-5 contains a sanitary landfill that was operated from 1963 to 1979, is located along the western border of TYAD, and is approximately 30 acres. The landfill received all types of waste including plating wastes, sludge from the sewage treatment plant, ash from burning of wood and paper rubble, construction debris, paints, solvents, oils, and sanitary solid waste. The landfill is composed of two cells. Cell A located in the northwest received non-hazardous waste and Cell B located in the southwest received hazardous wastes. The landfill was closed following closure plans approved by the former Pennsylvania Department of Environmental Resources (PADER), and U.S. EPA in accordance with the Resource Conservation and Recovery Act (RCRA). An approved engineered clay cover was constructed and a surface drainage feature that traversed the landfill from north to south was replaced by a storm drainage system. The original surface drainage feature was filled in and leveled during the closure procedures.

The site is currently vacant and railway tracks along the west side of the site have been abandoned. Site features are identified on Figure 5.

7.1.2 History of Contamination

The sanitary landfill at OU-5 was operated from 1963 to 1979. It received all types of wastes including plating wastes, sludge from the sewage treatment plant, ash from burning of wooden and paper rubble, construction debris, paints, solvents, oils, and sanitary waste. Landfill operations ceased on 1 July 1979 and the landfill was closed following closure plans approved by the PADEP and the U.S. EPA in accordance with RCRA.

7.1.3 Initial Response

No pre-ROD cleanup activities or response actions were performed at OU-5.

7.1.4 Basis for Taking Action

The basis for taking action at the inactive sanitary landfill was defined by a Risk Evaluation Study (USACHPPM 2000), the RI (ERM 1997), and the FS (PMC 2000b). Analysis of groundwater during the RI indicated the presence of VOCs, semi-volatile organic compounds (SVOCs), and inorganics in groundwater at the landfill. The concentrations were compared to U.S. EPA Region III Risk-Based Concentrations. The risk evaluation study found that detected concentrations of some compounds in groundwater at OU-5 exceeded U.S. EPA acceptable risk ranges and identified ingestion of groundwater as the only potential pathway of concern.

7.2 OU-5 REMEDIAL ACTIONS

7.2.1 Remedy Selection

RAOs were established to prevent ingestion of groundwater having contaminants in excess of established drinking water standards and to remediate contaminated drinking water to useable standards.

The COCs identified at OU-5 include 1,2-dichloropropane, benzene, PCE, TCE, vinyl chloride, bis(2-ethylhexyl)phthalate, pentachlorophenol, arsenic, and barium. Cleanup goals were set for these contaminants based on federal MCLs and are listed in Table 7.

The ROD for OU-5 was issued in September 2000 (USAEC 2000b). The selected remedy addressed contaminated groundwater by natural attenuation/LTM/ICs. The ROD did not provide an estimated time when the cleanup levels would be attained, other than "could exceed 30 years".

The LTM requirements described in the ROD included collection of samples semi-annually from existing groundwater monitoring wells and analysis for the COCs to monitor the progress of the remediation.

ICs would be implemented to prevent exposure to contaminated groundwater until the cleanup goals were met. They included an agreement between TYAD and the Coolbaugh Township Zoning Office to ensure that future residents will not be exposed to groundwater with contaminant concentrations above the cleanup levels. Construction of any on-post potable water well was prohibited in the area of groundwater contamination until remediation goals were met. Ongoing public education regarding potential hazards associated with consumption of contaminated groundwater and groundwater monitoring results were to be presented in the installation newspaper, "The Tobyhanna Reporter."

Table 7. OU-5 Groundwater Cleanup Levels

COC	Cleanup Level (µg/L)
VOCs	
1,2-DCP	5
Benzene	5
PCE	5
TCE	5
Vinyl chloride	2
SVOCs	
Bis(2-ethylhexyl)phthalate	6
Pentachlorophenol	1
Inorganics	
Arsenic	50[1]
Barium	2,000

[1] When the ROD was issued, the actual arsenic MCL as established in 40 CFR 141.61 was 50 µg/L. Subsequent to signing of the ROD, 40 CFR 141.61 for arsenic was changed to 10 µg/L.

Notes:

1,2-DCP	1,2-Dichloropropane
PCE	tetrachloroethene
TCE	trichloroethene
µg/L	micrograms per liter

7.2.2 Remedy Implementation

Implementation of the selected remedy, natural attenuation/LTM/ICs, is described in the remedial design/interim remedial action report (WESTON 2001). Semi-annual groundwater sampling continued using the existing monitoring well network to assess the effectiveness of natural attenuation. Groundwater monitoring used the same procedures and requirements as OU-1, which were detailed in the sampling and analysis plan section of the remedial design/interim remedial action report (WESTON 2001). To date, 23 rounds of groundwater sampling have been

conducted between February 2000 and October 2015. Groundwater samples were collected twice per year and analyzed for VOCs, SVOCs, total cyanide, and total and dissolved metals. The sampling frequency was reduced to once per year in 2007. VOCs are analyzed using U.S. EPA Method 8260B, SVOCs were analyzed by U.S. EPA Method 8270C, total cyanide was analyzed using U.S. EPA Method 9014, and metal analyses were performed according to U.S. EPA Methods 6010B and 7470A (EA 2016b). SVOCs were removed from the analyte list prior to the July 2015 sampling. This change to the monitoring requirements was recommended in the 2013 annual performance evaluation (WESTON 2014) because SVOCs had not been detected in any of the landfill monitoring wells for 9 years.

ICs for OU-5 are similar to those implemented at OU-1. A memorandum dated 15 September 2000 requested that the Coolbaugh Township Zoning Officer notify TYAD of any construction planned along Goldsboro Road to the west of OU-5. A memorandum for record dated 18 December 2000 stated that the Directorate of Public Works would not allow the construction of any drinking water wells in the area of the landfill (WESTON 2001). Copies of these memorandums are available in Attachment 11.

7.2.3 Maintenance and Monitoring

Monitoring requirements for OU-5 include sampling and analyzing groundwater, water level measurements, and preparing annual groundwater monitoring reports. The monitoring wells are also inspected during sampling to identify any damage. OU-5 is inspected quarterly by TYAD. Since the last five-year review, maintenance activities have included clearing of brush and shrub from the landfill cap.

Groundwater samples have been collected 23 times from February 2000 to October 2015. The samples were analyzed for TCL VOCs, TCL SVOCs, and total and dissolved metals. In 2007 the sampling frequency was reduced to once per year. SVOCs and total cyanide were removed from the list of analytes in 2012 due to a lack of detections. Table 8 provides a summary of the current groundwater monitoring program. The most recent groundwater sampling event took place from 19 to 22 October 2015. Monitoring is conducted using 14 wells, 10 located on-post and four located off-post. Well locations are shown on Figure 5.

Table 8. OU-5 Groundwater Monitoring Program

Well	Zone Monitored	Analytical Parameters	
		VOCs	Metals (total and dissolved)
On-Post Wells			
LF10	Bedrock	X	
LF11	Bedrock	X	
LF12	Bedrock	X	
LF13	Glacial Till	X[1]	X
LF19	Bedrock	X	
LF21	Glacial Till	X	
LF22	Glacial Till	X	X
LF23	Glacial Till		X

Table 8. OU-5 Groundwater Monitoring Program

Well	Zone Monitored	Analytical Parameters	
		VOCs	Metals (total and dissolved)
LF24	Glacial Till		X
LF25	Bedrock		X
Off-Post Wells			
LF26	Glacial Till	X	X
LF27	Bedrock	X	X
LF28	Glacial Till	X	X
LF29s	Bedrock	X	X

Notes:
1 VOCs collected but not required by the Long-Term Monitoring Plan

Wells LF11, LF13, and LF25 were sampled in October 2015 to assess whether geochemical conditions at the site are suitable for reductive dechlorination of chlorinated VOCs (PCE and TCE). Groundwater samples were analyzed for nitrate (as nitrogen), sulfate, ethane, ethene, methane, and total organic carbon. Field measurements were taken for pH, conductivity, temperature, ORP, turbidity, and DO.

7.3 OU-5 Progress Since Last Five-Year Review

The third five-year review (WESTON 2012a) included the following protectiveness statement for OU-5, The Inactive Sanitary Landfill:

> "The remedy at OU-5 (Natural Attenuation/Long-Term Monitoring/Institutional Controls) is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled."

7.3.1 Issues Identified during the Last-Five Year Review at OU-5

Two issues were identified in the third Five-Year Review that may affect the future protectiveness of the remedy (WESTON 2012a). These issues, their corresponding recommendations/follow-up actions, and their current status are summarized in Table 9.

Table 9. Issues Identified during the Last Five-Year Review at OU-5

Issues	Recommendations	Status
TCE groundwater concentrations – increasing trend. In 2004 there was a spike of TCE in the groundwater in several bedrock wells at OU-5 (potentially due to new sampling methods begun in 2004 or high groundwater levels in 2004). However, the concentrations of TCE found in the off post groundwater monitoring wells that	Investigate OU-5 to determine what is causing the levels of TCE to increase as part of the upcoming Annual Performance Evaluations of the remedy for OU-5. (First quarter 2014 milestone date)	The 2016 Remedy Assessment Report for Operable Unit 5 (EA 2017) investigated the probable cause of increased TCE levels in groundwater. PCE and TCE concentrations increased from below the MCLs to greater than the MCLs in April 2004, which coincides with a change of sampling methodology.

are downgradient of OU-5 are well below the MCL. So the contamination from this site is still contained within TYAD. This increasing trend should be reviewed as part of the planned re-evaluation of the MNA remedy for OU-5 before the next Five-Year Review.		
Re-evaluate MNA remedy. Based on the upward trends observed for the COCs at OU-5, the MNA remedy for OU-5 should be re-evaluated before the next Five-Year Review as part of the Annual Performance Evaluations.	Re-evaluate the MNA remedy for OU-5 in conjunction with the upcoming Annual Performance Evaluations.	The MNA remedy was evaluated in the 2016 Remedy Assessment Report (EA 2017) to determine if the selected remedy can achieve the RAOs within the allotted timeframe of 30 years. The assessment concluded that the remedy may not meet the RAOs within 30 years. Further discussion of this assessment is provided in section 7.5.1.1 of this five-year review.

7.4 SITE INSPECTION

The site inspection for OU-5 occurred on 21 July 2016. No issues affecting the protectiveness of the remedies were documented during the site inspection.

The site inspection forms and photographs taken during the site inspection are included in Attachments 4 and 5.

Observations made at OU-5 during the site inspection include:

- OU-5 is located inside a secure U.S. Army installation that is surrounded by a fence and access is controlled;
- TYAD perimeter fence runs along the west side of OU-5 and no damage was observed;
- Three passive gas vents are located on the landfill cap;
- Issues regarding the landfill surface including settlement, cracks, erosion, holes, bulges, wet areas, and slope instability were not observed;
- Siltation was not evident;
- Vegetation growth does not impede flow; and
- The discharge structure was functioning.

7.5 OU-5 DATA REVIEW

Recent groundwater data is presented in the *Draft Final 2015 Annual Performance Evaluation for Operable Units 1, 4, and 5* (EA 2016b). SVOCs were not analyzed. Attachment 10 includes recent and historic groundwater data and interpretations from the performance evaluation report.

- Figures 4-1 and 4-2 illustrate groundwater elevation contours in the glacial till and bedrock aquifers

- Table 4-3 presents October 2015 VOCs data
- Table 4-4 presents October 2015 data for select metals
- Table 4-6 presents historical benzene data; Figures 4-3 and 4-4 illustrate benzene concentrations in the glacial till and bedrock aquifers
- Table 4-7 presents historical PCE data; Figures 4-5 and 4-6 illustrate PCE concentrations in the glacial till and bedrock aquifers
- Table 4-8 presents historical TCE data; Figures 4-7 and 4-8 illustrate TCE concentrations in the glacial till and bedrock aquifers
- Table 4-9 presents historical vinyl chloride data; Figures 4-9 and 4-10 illustrate vinyl chloride concentrations in the glacial till and bedrock aquifers
- Figures 4-11 and 4-12 illustrate 1,2-DCP concentrations in the glacial till and bedrock aquifers
- Table A10-4 presents historical cis-1,2-DCE data

Results and interpretations are discussed below.

Groundwater Flow

According to the 2015 Annual Performance Evaluation Report (EA 2016b), groundwater movement in the shallow glacial till aquifer appears to be controlled by the landfill morphology and a storm water drainage system. The overall direction of groundwater flow in the glacial till is to the southwest. Groundwater in the bedrock aquifer also flows southwest from the landfill.

Groundwater Quality

Results of the most recent (October 2015) groundwater monitoring episode are summarized below.

- The 1,2-DCP cleanup level was not exceeded in any of the groundwater samples
- The benzene cleanup level was not exceeded in any of the groundwater samples
- The PCE cleanup level (5 µg/L) was exceeded in well LF11 (5.3 µg/L)
- The TCE cleanup level (5 µg/L) was exceeded in wells LF10 (9.4 µg/L), LF11 (15 µg/L), LF12 (6.6 µg/L), and LF19 (5.7 µg/L)
- The vinyl chloride cleanup level (2 µg/L) was exceeded in LF25 (5.7 µg/L)
- The arsenic cleanup level (50 µg/L) was exceeded in the total and dissolved samples at LF13 (21J[1]/19J µg/L), LF22 (30J/36J µg/L), and LF23 (110/100 µg/L)
- The barium cleanup level (2,000 µg/L) was exceeded in the total and dissolved samples at LF23 (2,200/2,200 µg/L)

Historical groundwater data indicates that PCE and TCE concentrations have generally exceeded the site cleanup levels at bedrock monitoring wells LF10, LF11, LF12, and LF19. An increase of PCE and TCE concentrations from below the MCLs to above the MCLs in these wells was seen starting in October 2004. The sampling methodology was changed in 2004 from using bailers to low-flow sampling. The low-flow sampling method provides better contaminant recovery so concentrations are reported as higher than prior to the sampling method change. The 2016 Remedy Assessment Report for Operable Unit 5 (EA 2017) demonstrates that PCE and TCE concentrations are inversely correlated with groundwater elevation. The report suggests that this

[1] J indicates an estimated value between the analytical method detection limit and Contract Required Detection Limit

relationship may indicate groundwater does not contact waste within the landfill. Cis-1,2-DCE and vinyl chloride, byproducts of PCE and TCE dechlorination, have been detected in downgradient wells LF25 and LF27 (bedrock) and LF22, LF23, LF26, and LF28 (glacial till).

This five-year review analyzed PCE and TCE concentration trends using the Normal Approximation Mann-Kendall Test and the Small-Sample Mann-Kendall Test for Trend for data sets with a sample size less than ten. The trends were evaluated using data from April 2004 to October 2015, when low-flow sampling was used. The trend analysis was conducted using a 95 percent confidence level. Time series plots and the Mann-Kendall trend results are included in Attachment 10. Results are also summarized in Table 10, which indicates decreasing trends or no trends were observed for all locations/COCs evaluated except:

- LF11; TCE concentrations exhibit an increasing trend. They have consistently exceeded the site cleanup level since April 2004. LF11 is screened in bedrock and located adjacent to a stormwater drainage pipe that traverses the site. The Mann-Kendall test was also performed at LF11 for data since 2009. This analysis showed a trend of decreasing TCE concentrations over the last 7 years of monitoring data.
- LF26; TCE concentrations exhibit an increasing trend. They have never exceeded the site cleanup level. LF26 is screened in glacial till and located off-post.

These results confirm trend analysis documented in the 2016 Remedy Assessment Report (EA, 2016c).

7.5.1.1 MNA Remedy Evaluation

The MNA remedy was re-evaluated by EA in the 2016 Remedy Assessment Report (EA, 2016c). Attachment 10 includes Table 3-5 and Table 3-6 from the report, which provides an interpretation of data collected in 2015 to assess the geochemical environment at OU-5. The evaluation concluded that based on the limited data collected during the evaluation, limited anaerobic reductive dechlorination is likely occurring offsite in downgradient wells while subsurface conditions within the landfill boundary prevent or strongly inhibit dechlorination. The evaluation estimates that it will take longer than 30 years to meet the cleanup goals.

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Table 10. Summary of Mann-Kendall Trend Analysis for Groundwater Sampling at OU-5

Well	Zone Monitored	COC				Comments
		PCE	TCE	Vinyl Chloride	Benzene	
OU-5						
On-Post						
LF10	Bedrock	NT	NT	NE	NE	PCE not detected above SCL since October 2013, TCE frequently detected above SCL since April 2004, vinyl chloride and benzene never detected above SCLs.
LF11	Bedrock	NT	U	NE	NE	PCE and TCE frequently detected above SCL since April 2004, vinyl chloride and benzene never detected above SCL. Downward TCE trend for data monitored 2009-2015.
LF12	Bedrock	D	NT	NE	NE	PCE not detected above SCL since November 2010, TCE detected above SCL in October 2015, vinyl chloride and benzene never detected above SCLs.
LF19	Bedrock	NT	NT	NE	NE	PCE not detected above SCL since October 2013, TCE routinely detected above SCL from October 2003 to October 2015, vinyl chloride and benzene never detected above SCLs.
LF21	Glacial till	NT	NE	NE	NE	TCE detected above SCL in November 2011, PCE, vinyl chloride and benzene never detected above SCLs.
LF22	Glacial till	NE	NE	NE	D	Benzene not detected above SCL since April 2005, PCE, TCE, and vinyl chloride never detected above SCLs.
LF23	Glacial till	NE	NE	D	NT	Vinyl chloride not detected above SCL since April 2007, benzene not detected above SCL since November 2010, PCE and TCE never detected above SCLs.
LF25	Bedrock	NE	NE	U	NE	Vinyl chloride frequently detected above SCL, benzene not detected above SCL since October 2003, PCE and TCE never detected above SCLs.
Off-Post						
LF26	Glacial till	NE	U	NE	D	PCE, TCE, vinyl chloride, and benzene never detected above SCLs.

LF27	Bedrock	NE	NT	NE	NE	PCE, TCE, vinyl chloride, and benzene never detected above SCLs.

Notes:

D	Downward trend
NE	Not evaluated
NT	No trend
U	Upward trend
---	Parameter not analyzed

7.6 OU-5 TECHNICAL ASSESSMENT

7.6.1 Question A:

Is the Remedy Functioning as Intended by the Decision Document?

Yes, the remedy is functioning as intended by the decision document. The information supporting this response is summarized below relative to the RAOs established in the OU-5 ROD:

- Prevent ingestion of groundwater having contaminants in excess of established drinking water standards.

  ICs include an agreement with the Coolbaugh Township Zoning Office to notify TYAD of any new construction involving potable water and prohibiting the construction of on-post drinking water wells in the contaminated groundwater plume prevent contact with contaminated groundwater. Site inspection observations indicate that new potable water supply wells have not been constructed in the area of OU-5. There are no complete exposure pathways for contaminated groundwater.

- Remediate contaminated groundwater to useable standards.

  Groundwater quality at the site has improved. The size and concentration of contaminant plumes have generally decreased in size over time. Further migration of contaminated groundwater has been minimized by the landfill cap and closure measures that were implemented in accordance with RCRA and closure plans approved by PADEP and U.S. EPA.

7.6.2 Question B:

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Still Valid?

No, The USEPA drinking water standard for arsenic decreased from 50 µg/L to 10 µg/L on January 22, 2001.

Exposure to hazardous substances at OU-5 is being prevented by the landfill cap and the restrictions on groundwater use. Updates in toxicity criteria for COCs established in the ROD do not affect the protectiveness of the groundwater cleanup levels (Attachment 8). No exposure to ecological receptors is expected.

There are no newly promulgated or modified requirements of federal or state environmental laws that would change the current protectiveness of the remedy (Attachment 7). To ensure long-term protectiveness, an explanation of significant differences to the OU-5 ROD must be issued to adjust the arsenic groundwater RG/MCL from 50 to 10 µg/L.

7.6.3 Question C:

Has any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

Consideration should be given to the potential for per- and polyfluoroalkyl substances (PFAS) and dioxins to be present in groundwater due to past site use including landfilling of plating waste and ash from burning of wood and paper rubble. The installation has indicated that the

drinking water aquifer was monitored for PFAS with non-detectable results and limited sampling for PFAS in the CERCLA monitoring well network is scheduled for the first quarter of fiscal year 2018. Future sampling for dioxins should also be considered.

No ecological risks have been identified. There have been no impacts from natural disasters.

7.6.4 Summary

The remedy is functioning as intended by the ROD, exposure assumptions, toxicity data, cleanup levels, ARARs, and RAOs used at the time of the remedy selection are still valid. No other information has come to light that could call into question the protectiveness of the remedy.

7.7 OU-5 ISSUES

No issues affecting protectiveness were identified at OU-5.

7.8 RECOMMENDATIONS AND OTHER FINDINGS

7.8.1 Recommendations

There are no recommendations for issues that affect protectiveness.

7.8.2 Other Findings

Table 11. Other Findings and Recommendations at TYAD OU-5

Findings	Recommendations
The ICs defined in the ROD include reporting monitoring results in the installation newspaper, The Tobyhanna Reporter. This has not been done for recent sampling events.	Monitoring results should be published in the Tobyhanna Reporter as specified by the ROD.
The arsenic MCL was incorrectly documented in the ROD as 5 µg/L instead of 50 µg/L as stated in 40 CFR 141.61 as the time the ROD was signed. The USEPA drinking water standard for arsenic decreased from 50 µg/L to 10 µg/L on January 22, 2001.	The updated arsenic MCL (10 µg/L) should be documented in an explanation of significant differences (ESD) to the OU-5 ROD. The 2016 Remedy Assessment Report should be amended to include an evaluation of the remedy's ability to achieve the RAOs given the updated arsenic MCL.
Monitoring of SVOCs in groundwater ceased in 2015 due to a number of nondetect results.	The sampling plan should be updated to reflect the cessation of monitoring for SVOCs at OU-5.

7.9 OU-5 PROTECTIVENESS STATEMENT

The remedy at OU-5 is protective of human health and the environment.

ICs prevent contact with contaminated groundwater through an agreement between TYAD and the Coolbaugh Township to notify TYAD of any new construction involving potable water and prohibiting construction of any on-post drinking water well in the contaminated groundwater plume. Reduction in contaminant plume size over time has been achieved through natural attenuation.

8.0 SITE WIDE PROTECTIVENESS STATEMENT

The remedies at OU-1 Areas A and B, OU-4, and OU-5 are protective of human health and the environment

The remedies have been implemented and are functioning as intended by the RODs; the RAOs are being met. Institutional controls are preventing exposure to contaminants (OU-1 and OU-5) and unexploded ordnance (OU-4). Contaminants in groundwater at OU-1 are being reduced by natural processes.

9.0 NEXT REVIEW

The next five year review for TYAD will be due on 27 September 2022, five years after the due date of this review.

ATTACHMENT 1

Figures

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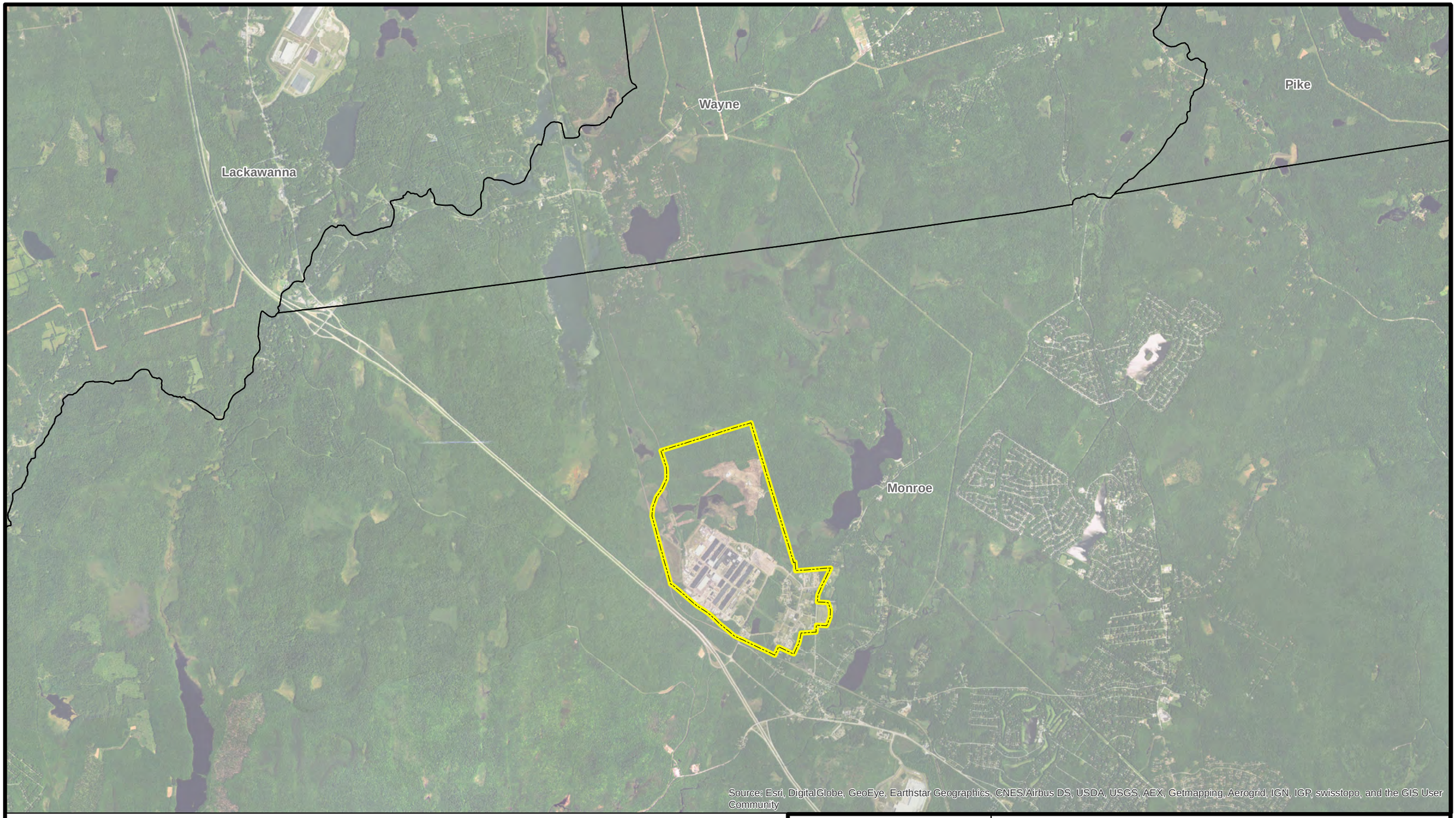

Tobyhanna Army Depot Boundary

Pennsylvania County Boundaries

N
W E
S

0 0.45 0.9 1.8
Miles

US Army Corps of Engineers
Buffalo District

Tobyhanna Army Depot Location

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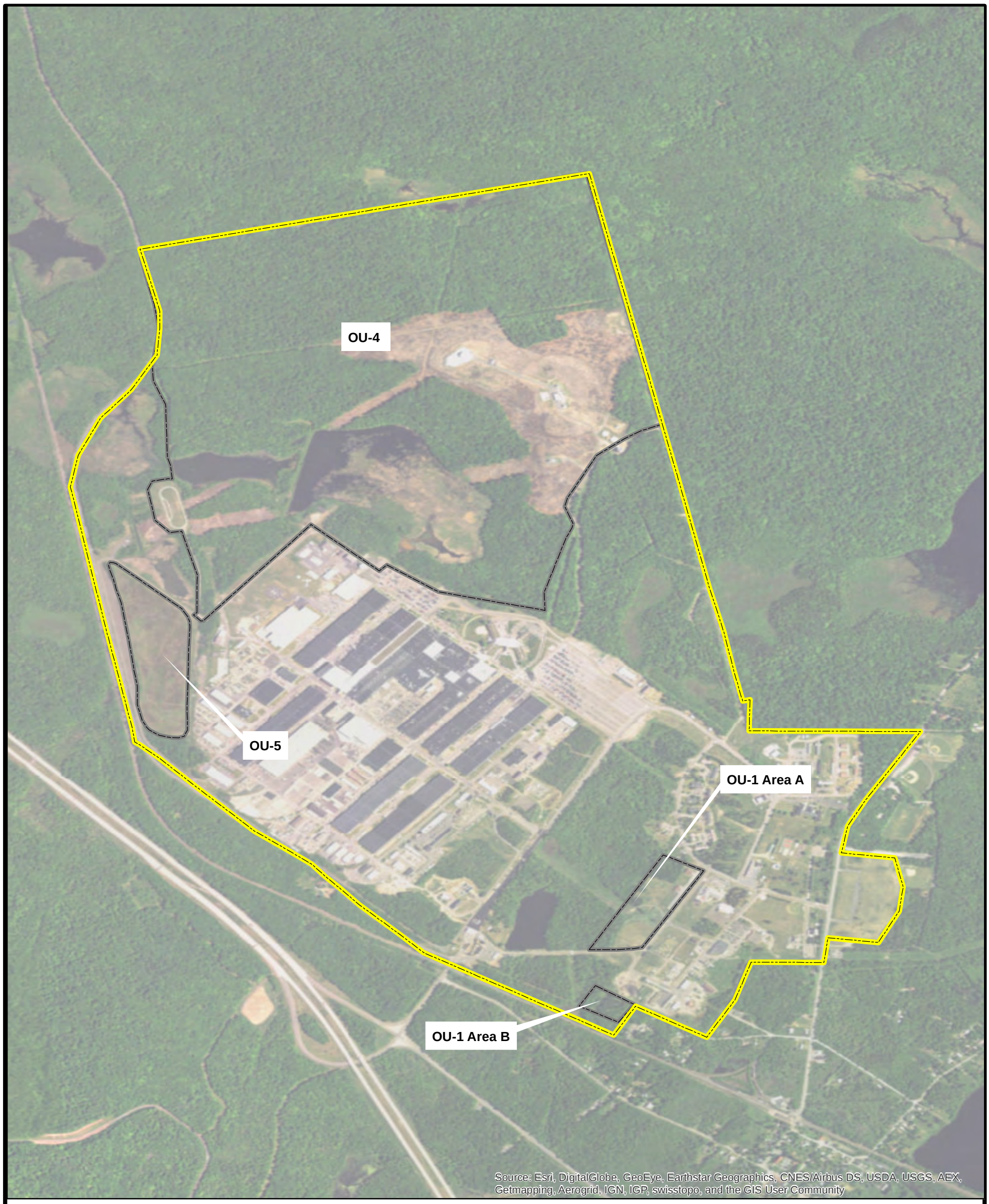
Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

Figure 1



N
W E
S

Tobyhanna Army Depot

Institutional Control Boundary

0 0.5 1 Miles

US Army Corps of Engineers
Buffalo District

Site Overview

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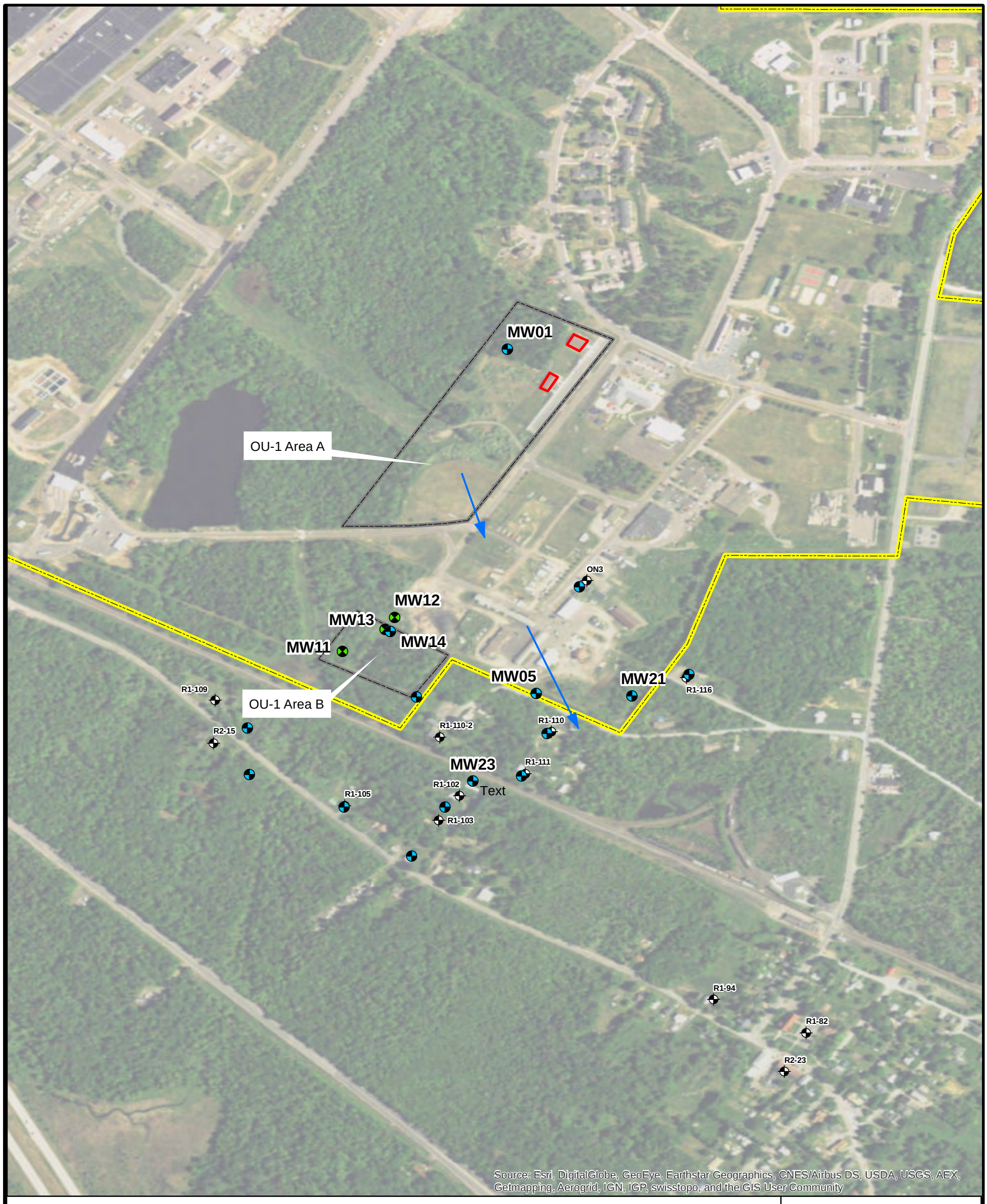
Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

FIGURE 2



Residential Well

Bedrock Well

Overburden Well

Approximate Groundwater Flow Direction

New office building constructed with vapor barrier and passive ventilation system

Institutional Control Boundary

Tobyhanna Army Depot Boundary

NOTE: Groundwater sampling results for COCs at OU-1 are presented in Attachment 10 Tables 2-3, 2-4, and 2-5

N W E S

0 500 1,000 Feet

OU-1 Groundwater Cleanup Levels

COC	Cleanup Levels (ug/L)
PCE	5
TCE	5
Vinyl Chloride	2

US Army Corps of Engineers
Buffalo District

OU-1 Site Features

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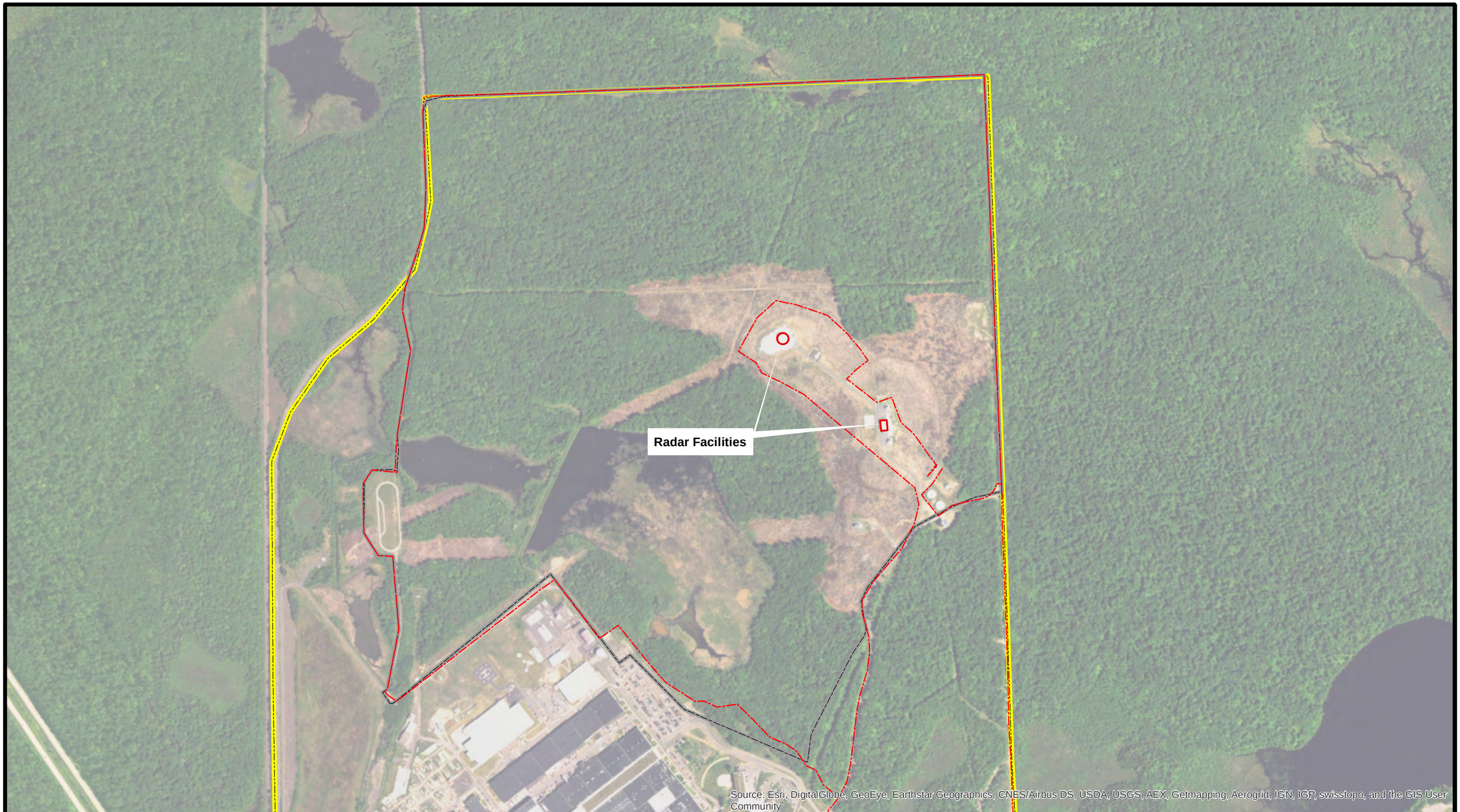
Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

FIGURE 3



Fence Line

Radar Buildings

Institutional Control Boundary

Tobyhanna Army Depot Boundary

N

W E

S

0 250 500 1,000

Feet

US Army Corps of Engineers
Buffalo District

OU-4 Site Features

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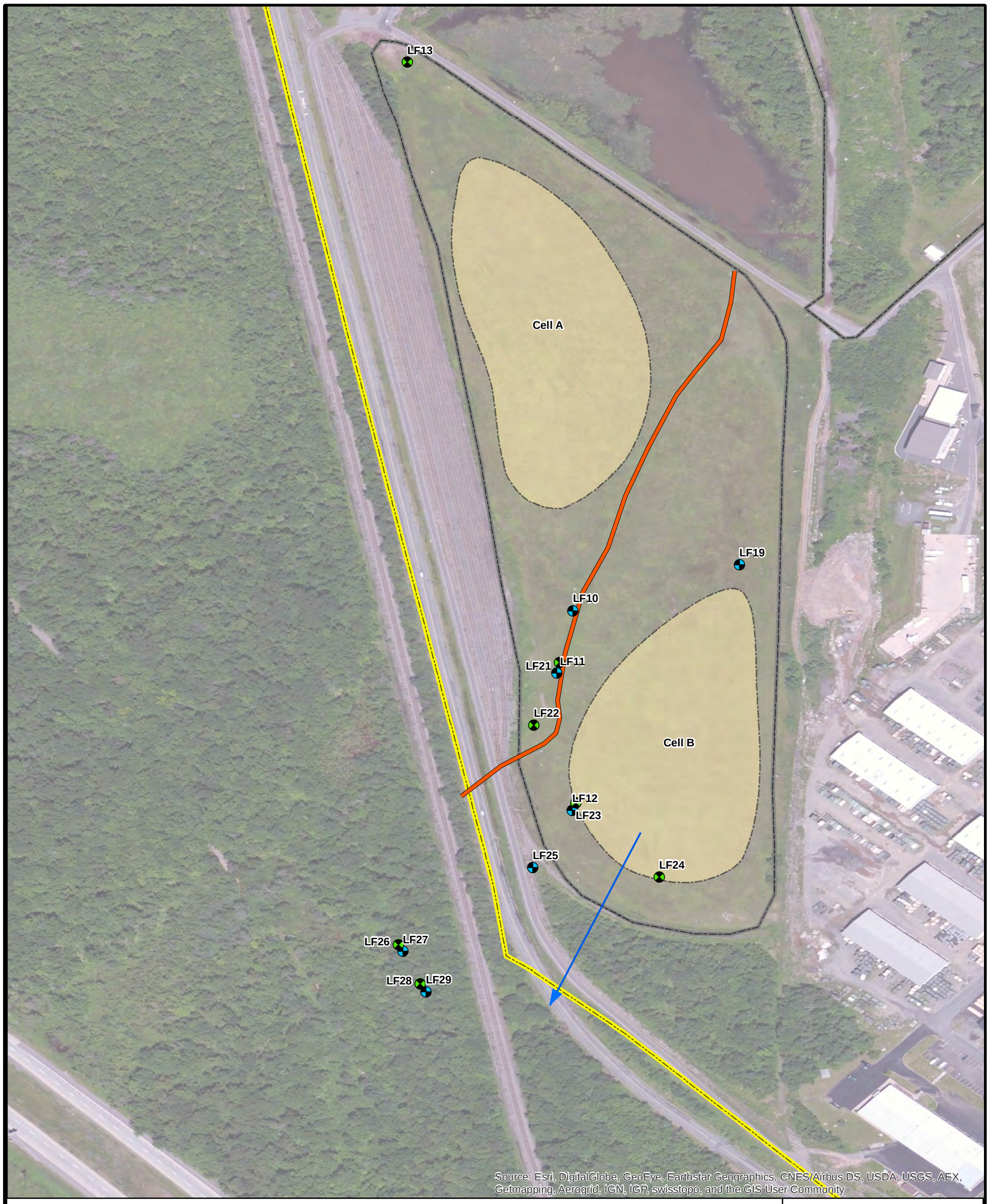
Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

Figure 4



Bedrock Well

Overburden Well

Approximate Groundwater Flow Direction

Stormwater Drainage Pipe

Approximate Landfill Cell

Institutional Control Boundary

Tobyhanna Army Depot Boundary

N
W E
S

0 250 500
Feet

NOTE: Groundwater sampling results for COCs at OU-5 are presented in Attachment 10 Tables 4-3, 4-4, 4-6, 4-7, 4-8, and 4-9.

OU-5 Groundwater Cleanup Levels

COC	Cleanup Levels (ug/L)
1,2-Dichloropropane	5
Benzene	5
PCE	5
TCE	5
Vinyl Chloride	2
Bis(2-ethylhexyl) phthalate	6
Pentachlorophenol	1
Arsenic	50
Barium	2000

US Army Corps of Engineers
Buffalo District

OU-5 Site Features

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Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

FIGURE 5

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ATTACHMENT 2

Documents Reviewed

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Documents Reviewed

EA Engineering, Science, and Technology, Inc. (EA) 2016a. Draft Final 2014-2015 Annual Performance Evaluation for Operable Units 1, 4, and 5. March.

EA 2016b. Draft Final 2015 Annual Performance Evaluation for Operable Units 1, 4, and 5. June.

EA 2017. Final 2016 Remedy Assessment Report for Operable Unit 5 (TBAD-001). February 24.

Environmental Resources Management (ERM) 1997. Final Tobyhanna Army Depot, Tobyhanna, PA Remedial Investigation, AOC #1 – Inactive Sanitary Landfill Technical Report, ELIN A009. August 15.

Environmental Science and Engineering, Inc (ESE) 1988. Remedial Investigation/Feasibility Study at Tobyhanna Army Depot Final Remedial Investigation Report A011. December.

ESE 1989. Remedial Investigation/Feasibility Study at Tobyhanna Army Depot Revised Draft Endangerment Assessment Report. March.

ESE 1992. Remedial Investigation/Feasibility Study at Tobyhanna Army Depot Final Feasibility Study Report for the Areas A and B Operable Unit. December 17.

ESE 1993. Final Proposed Remedial Action Plan for Operable Unit 1 at Tobyhanna Army Depot Tobyhanna, Pennsylvania. September 28.

ESE 1997a. Draft Final Proposed Remedial Action Plan Operable Unit 1 Tobyhanna Army Depot Tobyhanna, Pennsylvania. March.

ESE 1997b. Final Tobyhanna Army Depot Operable Unit 1 (Areas A and B) Record of Decision. September 30.

Program Management Company (PMC) 2000a. Final Tobyhanna Army Depot Tobyhanna, PA Engineering Evaluation/Cost Analysis Area of Concern 55 UXO Area on Powder Smoke Ridge. April 17.

PMC 2000b. Final Tobyhanna Army Depot Tobyhanna, PA Focused Feasibility Study Area of Concern #1 Inactive Sanitary Landfill. July 10.

Tobyhanna Army Depot (TYAD) and USEPA 2013. Addendum to Third Five-Year Review Report Tobyhanna Army Depot. June 2013.

U.S. Army 2015. FY2015 Tobyhanna Army Depot Army Defense Environmental Restoration Program Installation Action Plan. September 9.

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) 2000. Final Risk Evaluation NO. 39-EJ-4330-00 Inactive Sanitary Landfill (Area of Concern-1) Tobyhanna Army Depot Tobyhanna, Pennsylvania. July.

U.S. Army Corps of Engineers (USACE) 2013. *EM 200-1-16 Environmental Statistics.* May 31.

U.S. Army Environmental Center (USAEC) 2000a. Record of Decision Operable Unit #4, Tobyhanna Army Depot, Tobyhanna, Pennsylvania. September.

USAEC 2000b. Record of Decision Operable Unit #5, Tobyhanna Army Depot, Tobyhanna, Pennsylvania. September.

U.S. Army Corps of Engineers (USACE) 1995. Ordnance and Explosive Archives Search Report for Former Tobyhanna Artillery Range. September.

U.S. Environmental Protection Agency (U.S. EPA) 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water. September.

U.S. EPA 1990. *National Oil and Hazardous Substances Pollution Contingency Plan Final Rule, FR Vol. 55, No. 46, March 8.* Available from U.S. Government Printing Office, Washington, D.C.

U.S. EPA 2000. Preliminary Close Out Report. September 28.

U.S. EPA 2001a. Remedial Action Report Tobyhanna Army Depot Superfund Site Natural Attenuation/Long Term Monitoring/ Institutional Controls of Contaminated Groundwater (OU 1). March 13.

U.S. EPA 2001b. Remedial Action Report Tobyhanna Army Depot Superfund Site Institutional Controls of UXO Area (OU4). March 13.

U.S. EPA 2001c. *EPA 540-R-01-007, Comprehensive Five-Year Review Guidance*. June

U.S. EPA 2012. *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews, OSWER 9200.2-111.* September

U.S. EPA 2014. *Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well.* August

WESTON Solutions, Inc. (WESTON) 1998. Final Remedial Design for Operable Unit 1 (Areas A and B) Tobyhanna Army Depot. December.

WESTON 2001. Remedial Design/Interim Remedial Action Report of Operable Unit 5 Tobyhanna Army Depot. February.

WESTON 2002. Five-Year Review Report for Operable Unit 1 (Areas A and B), Operable Unit 4 and Operable Unit 5 Tobyhanna Army Depot Final. September.

WESTON 2007. Second Five-Year Report for Operable Unit 1 (Areas A and B), Operable Unit 4 and Operable Unit 5 Tobyhanna Army Depot Final. September.

WESTON 2012a. Third Five-Year Report for Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5 Tobyhanna Army Depot Final. September.

WESTON 2012b. Final Vapor Intrusion Pathway Study Report Tobyhanna Operable unit 1 (OU-1). November.

WESTON 2013. Final 2012 Annual Performance Evaluation for Operable Unit 1, 4 and 5 Tobyhanna Army Depot. July.

WESTON 2014. Final 2013 Annual Performance Evaluation for Operable Unit 1, 4 and 5 Tobyhanna Army Depot. September.

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ATTACHMENT 3

Decision Document Summaries

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Table A3-1 Decision Document Summary
Component: Background/Basis for Taking Action at TYAD OU-1

Decision Document Title:	Final Tobyhanna Army Depot Operable Unit 1 (Areas A and B) Record of Decision. Prepared by Environmental Science & Engineering, Inc. Dated September 1997.
Regulatory Framework:	CERCLA NPL
Remedy Chosen:	Natural Attenuation/Long-Term Monitoring/Institutional Controls
Media of Concern:	Groundwater
Constituents of Concern (COCs):	**Soil:** N/A (No Further Action) **Groundwater:** trichloroethene (TCE), tetrachloroethene (PCE), vinyl chloride
Land Use:	Current: Commercial, industrial and Area B off-post residential Future: Commercial, industrial and residential
Receptors:	Current Areas A and B: Adult, child Hypothetical future Areas A and B: Resident adult and child Current and hypothetical future Area B off-post sites: Resident adult and child
Exposure Pathways:	Current Areas A and B: Ingestion of contaminated fish from Barney Lake Hypothetical future Areas A and B: Ingestion of groundwater, inhalation of volatiles Current and hypothetical future Area B off-post sites: Direct dermal contact, ingestion of groundwater, ingestion of contaminated vegetables, inhalation from watering vegetables
Ecological Risk:	No significant impacts to ecological receptors have been identified

Table A3-2 Decision Document Summary
Component: Remedial Action at TYAD OU-1

Decision Document Title:	Final Tobyhanna Army Depot Operable Unit 1 (Areas A and B) Record of Decision. Prepared by Environmental Science & Engineering, Inc. Dated September 1997.
Remedy Chosen:	Natural Attenuation/Long-Term Monitoring/Institutional Controls
Remedial Action Objectives (RAOs):	(1) Minimize the potential for future migration of VOCs in groundwater (2) Restore groundwater in the glacial till and bedrock aquifers to beneficial use and to levels protective of human health and the environment, as soon as possible, through natural attenuation
Clean-Up Goals:	TCE: 5 µg/L PCE: 5 µg/L Vinyl Chloride: 2 µg/L
Applicable or Relevant and Appropriate Requirements (ARARs):	The contaminant-specific ARARs are federal [40 CFR 141.61(a)] and state [PA 109.202(a)(2) and (3)] MCLs. The "Statewide Human Health Standards" under the Land Recycling and Environmental Remediation Standards Act is a TBC requirement. No action-specific or location-specific ARARs were identified.
Components of the Remedy:	(1) Natural attenuation of groundwater (2) Groundwater sampling to determine if size and strength of plume are decreasing over time (3) Supply water to residences and businesses that have wells with VOC concentrations in excess of MCLs (4) Institutional controls that request the Coolbaugh Township Zoning Officer notify TYAD of new construction ensuring new wells are not placed in the contamination area; Institutional control prohibiting the construction of any on-post drinking water well in the plume of groundwater contamination

Table A3-3 Decision Document Summary
Component: Background/Basis for Taking Action at TYAD OU-4

Decision Document Title:	Record of Decision Operable Unit #4 Tobyhanna Army Depot Tobyhanna Pennsylvania. Dated September 2000.
Regulatory Framework:	CERCLA NPL
Remedy Chosen:	Institutional Controls: physical controls, security patrols/monitoring, UXO support, proprietary controls, public/employee education, periodic reviews
Media of Concern:	Unexploded ordnance
Constituents of Concern (COCs):	**Soil:** N/A **Groundwater:** N/A
Land Use:	Current: Industrial Future: Industrial
Receptors:	Workers, trespassers
Exposure Pathways:	Explosion or improper handling of UXO
Ecological Risk:	None identified

Table A3-4 Decision Document Summary
Component: Remedial Action at TYAD OU-4

Decision Document Title:	Record of Decision Operable Unit #4 Tobyhanna Army Depot Tobyhanna Pennsylvania. Dated September 2000.
Remedy Chosen:	Institutional Controls: physical controls, security patrols/monitoring, UXO support, proprietary controls, public/employee education, periodic reviews
RAOs:	(1) Reduce potential exposure to UXO by on-site workers or trespassers (2) Ensure that proper UXO clearance procedures are followed if or when any portion of this area is to be developed by the Army in the future (3) Restrict future uses of the land (4) Educate the public/employees on the dangers of UXO at AOC #55
Clean-Up Goals:	Restrict access to the UXO site to minimize the threat of explosion and injury to people.
ARARs:	No ARARs exist, several Army policy documents and directives address explosive safety and are "to be considered."
Components of the Remedy:	The remedy consists of the following institutional controls: • Physical controls – barbed wire fence and signs posted around the perimeter of OU-4 • Security patrols/monitoring – minimize the number of trespassers especially during hunting season • UXO support – Explosives Ordnance Disposal trained personal to provide support in the case of intrusive activities by the Army • Proprietary controls – deed restrictions on the land if it is ever transferred outside the government • Public/employee education – Informing the public and TYAD employees of the dangers of contact with potential UXO • Periodic review – a review at a minimum of every five years to determine the effectiveness of the remedy

Table A3-5 Decision Document Summary
Component: Background/Basis for Taking Action at TYAD OU-5

Decision Document Title:	Record of Decision Operable Unit #5 Tobyhanna Army Depot Tobyhanna Pennsylvania. Dated September 2000.
Regulatory Framework:	CERCLA NPL
Remedy Chosen:	Natural Attenuation/Long-Term Monitoring/Institutional Controls
Media of Concern:	Groundwater
COCs:	**Soil:** N/A **Groundwater:** Barium, Arsenic, Benzene, Vinyl Chloride, 1,2-Dichloropropane, PCE, TCE, Pentachlorophenol, Bis (2-ethylhexyl)phthalate
Land Use:	Current: Vacant Future: Vacant
Receptors:	Resident adults and children
Exposure Pathways:	Ingestion, dermal absorption, and inhalation
Ecological Risk:	No ecological risk was identified

Table A3-6 Decision Document Summary
Component: Remedial Action at TYAD OU-5

Decision Document Title:	Record of Decision Operable Unit #5 Tobyhanna Army Depot Tobyhanna Pennsylvania. Dated September 2000.
Remedy Chosen:	Natural Attenuation/Long-Term Monitoring/Institutional Controls
RAOs:	(1) Prevent ingestion of groundwater having contaminants in excess of established drinking water standards (2) Remediate contaminated ground water to useable standards
Clean-Up Goals:	Barium: 2000 µg/L Arsenic: 50 µg/L Benzene: 5 µg/L Vinyl Chloride: 2 µg/L 1,2– Dichloropropane: 5 µg/L PCE: 5 µg/L TCE: 5 µg/L Pentachlorophenol: 1 µg/L Bis(2-ethylhexyl)phthalate: 6 µg/L
ARARs:	Safe Drinking Water Act
Components of the Remedy:	(1) Natural attenuation of groundwater (2) Groundwater monitoring to determine of the plume is stable and natural attenuation is occurring (3) Institutional controls consisting of an agreement with Coolbaugh Township regarding notification of new construction and ensuring that no wells are placed in the area of contamination and prohibition on construction of any on-post drinking water well in the area of OU-5, public education regarding the contaminated groundwater in OU-5, and results of long-term monitoring presented to all in employees in the installation newspaper

ATTACHMENT 4

Site Inspection Checklists

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Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-1 (Areas A and B)
(TBAD-004)

I. SITE INFORMATION

Site name: *Tobyhanna Army Depot (TYAD) Operable Unit 1 (Areas A and B)*	**Date of inspection:** *July, 21, 2016*
Location and Region: *Monroe County, PA/USEPA Region 3*	**EPA ID:** *PA5213820892*
Agency, office, or company leading the five-year review: *US Army Corps of Engineers, Buffalo District*	**Weather/temperature:** *Sunny, westerly wind, ~85ºF*

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS (see Attachment 6)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Monitoring requirements are provided in *Final Remedial Design for Operable Unit 1 (Areas A and B) Tobyhanna Army Depot, December 1998.* 2007 correspondence between TYAD and USEPA documents reduction in sampling frequency to once per year.

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: Contractor safety plans are on file at TYAD.

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: _____

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-1 (Areas A and B)
(TBAD-004)

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks : _____

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks: Records are available in Annual Performance Evaluation reports.

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks _____

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☒ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: _____

2. **O&M Cost Records** (Not available)

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available (not available)

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: Monitoring/inspection costs are not available.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-1 (Areas A and B)
(TBAD-004)

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A

Remarks: OU-1 Areas A & B are located inside a secure U.S. Army installation that is surrounded by a fence. Access to the installation is controlled.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self-reporting, results provided to USEPA
Frequency Annual
Responsible party/agency U.S. Army
Contact Matt Argust (Name) Installation Restoration Manager (Title) July 21, 2016 (Date) (570) 615-6594 (Phone no.)

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached
None

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. **Land use changes on site** ☐ N/A
Remarks: New office buildings were constructed on Corporal Damato Street after the Record of Decision (ROD) and Remedial Design were completed. The buildings are situated in the footprint of Area A and were constructed with sub-slab vapor barriers and passive ventilation systems.

3. **Land use changes off site** ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☒ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: Roads adjacent to the site consist of bituminous concrete pavement.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-1 (Areas A and B)
(TBAD-004)

B. Other Site Conditions

Remarks Areas A and B consist predominately of grass covered, vacant areas. A baseball diamond is situated in the southern portion of Area A. Wooded areas, roads, and new buildings surround Area A. Wooded areas and a Directorate of Public Works storage facility surround Area B.

NOTE: Sections VII through X were removed from this checklist because they are not applicable

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy for OU-1 was intended to: 1) minimize the potential for future migration of VOCs in groundwater, 2) restore groundwater in glacial till and bedrock aquifers to beneficial use and to levels that are protective of human health and the environment, and 3) prevent exposure of groundwater until it has been restored to federal Maximum Contaminant Levels. The remedy consists of natural attenuation, long-term monitoring, and institutional controls for groundwater.

Site inspection observations indicate that no new potable water wells have been installed in accordance with institutional controls identified in the 1997 ROD. A soil removal action was conducted at Area B in 1995 to remove contaminated soil to minimize the potential for future migration of VOCs by removing the source of contamination. The aquifers are to be restored to beneficial use through monitored natural attenuation. The contaminate plumes have decreased in size over time and only one exceedance of a cleanup goal was reported during the 2015 monitoring event.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Monitoring consists of annual groundwater sampling for Target Compound List VOCs. Prior monitoring (i.e. before 2007) was conducted semi-annually and included lead (before 2004). The status of institutional controls has been reviewed during previous five-year reviews conducted in 2002, 2007, and 2012. An access agreement should be re-established at property R1-94. Sample results from this property are important for the development of complete and accurate contaminant plume maps. Wells pumps at R1-105 and R2-15 should be repaired so the wells can be sampled in 2016. Groundwater elevations should be collected for the following wells that are not included in the sampling program so that the groundwater flow in the area can be better delineated: MW04, MW07, MW19, MW20, and MW22.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Remove residential well R1-116 from the sampling program because contaminants have not been detected or were less than 1 µg/L for 12 years and the well is not required for plume delineation.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-4 (TYAD-001-R-01)

I. SITE INFORMATION

Site name: *Tobyhanna Army Depot Operable Unit 4*	**Date of inspection:** *July, 21, 2016*
Location and Region: *Monroe County, PA/USEPA Region 3*	**EPA ID:** *PA5213820892*
Agency, office, or company leading the five-year review: *US Army Corps of Engineers, Buffalo District*	**Weather/temperature:** *Sunny, westerly wind, ~85°F*

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS (See Attachment 6)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: Contractor safety plans are on file at TYAD.

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits_____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: _____

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-4 (TYAD-001-R-01)

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks : _____

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks _____

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☒ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: _____

2. **O&M Cost Records** (Not available)

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available (not available)

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: Monitoring/inspection costs are not available.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☒ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: Minor damage to perimeter barbed wire fence from fallen tree limbs observed on east side of OU-4. TYAD routinely inspects the fence and the observed damage will be repaired.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-4 (TYAD-001-R-01)

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: Signs placed uniformly on perimeter fence, *"Danger Unexploded Ordnance Explosives KEEP OUT"*

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self-reporting, results provided to USEPA
Frequency Annual
Responsible party/agency U.S. Army
Contact Matt Argust (Name) Installation Restoration Manager (Title) July 21, 2016 (Date) (570) 615-6594 (Phone no.)

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached
None

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. **Land use changes on site** ☐ N/A
Remarks: Construction of new radar site planned. Unexploded ordnance clearance activities conducted in the construction areas.

3. **Land use changes off site** ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: Site roads are bituminous concrete pavement and gravel/soil.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-4 (TYAD-001-R-01)

B. Other Site Conditions

Remarks OU-4 is an approximately 584 acre area located on Powder Smoke Ridge. It is predominately undeveloped and forested. Radar installations and water storage tanks are present on the top of Powder Smoke Ridge. OU-4 is surrounded with a five-strand barbed wire fence. A contiguous area along the fence, inside OU-4, has been cleared to facilitate inspection of the fence. Interior security fences are present along roads and radar sites to prevent access to areas that have not been cleared for UXO.

NOTE: Sections VII through X were removed from this checklist because they are not applicable

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy for OU-4 was intended to: 1) reduce potential exposure to unexploded ordnance (UXO) by on-site workers or trespassers, 2) ensure that proper UXO clearance procedures are followed if or when the area is to be developed by the Army in the future, 3) restrict future uses of the land, and 4) educate the public employees on the dangers of UXO at OU-4. The remedy consists of institutional controls, which include physical controls, security patrols/monitoring, UXO support, proprietary controls, public/employee education, and periodic (five-year) review.

Site inspection observations indicate that perimeter and interior fences and signs are maintained and routinely patrolled to reduce the potential for exposure to UXO. Clearance procedures are followed for areas where future development is to occur. TYAD implements UXO safety training for new employees and visitors. It consists of a 15 minute UXO safety video and UXO safety pamphlet.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Maintenance and inspection activities are adequate to ensure protectiveness of the remedy.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

I. SITE INFORMATION

Site name: *Tobyhanna Army Depot (TYAD) Operable Unit 5*	**Date of inspection:** *July 21, 2016*
Location and Region: *Monroe County, PA/USEPA Region 3*	**EPA ID:** *PA5213820892*
Agency, office, or company leading the five-year review: *US Army Corps of Engineers, Buffalo District*	**Weather/temperature:** *Sunny, westerly wind, ~85ºF*

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS (see Attachment 6)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Monitoring requirements are provided in *Final Remedial Design for Operable Unit 1 (Areas A and B) Tobyhanna Army Depot, December 1998.* 2007 correspondence between TYAD and USEPA documents reduction in sampling frequency to once per year.

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: Contractor safety plans are on file at TYAD.

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits_____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: _____

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks : _____

7. **Groundwater Monitoring Records** ☒ Readily available ☐ Up to date ☐ N/A
Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks _____

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☒ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A
Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: _____

2. **O&M Cost Records** (Not available)

☐ Not available ☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available _____

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: Monitoring/inspection costs are not available.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: TYAD perimeter fence is near the west side of the OU. Damage was not observed.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: OU-5 is located inside a secure U.S. Army installation that is surrounded by a fence. Access to the installation is controlled.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self-reporting, results provided to USEPA
Frequency Annual
Responsible party/agency U.S. Army

Contact	Matt Argust	Installation Restoration Manager	July 21, 2016	(570) 615-6594
	Name	Title	Date	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached
None

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks:

2. **Land use changes on site** ☒ N/A

Remarks: None

3. **Land use changes off site** ☒ N/A

Remarks: None

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☒ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks: There are no roads on site. Roads adjacent to the site consist of bituminous concrete pavement.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

B. Other Site Conditions

Remarks: OU-5 consists of two closed landfill cells, a non-hazardous cell and a hazardous cell. The landfill and surrounding area are grass-covered and open. A drainage swale is situated between the cells and subsurface storm drains surround the cells. A railroad yard is situated west of the site.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface ☒ Applicable ☐ N/A

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent _____ Depth _____
   Remarks: _____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
   Lengths: _____ Widths: _____ Depths: _____
   Remarks: _____

3. **Erosion** ☒ Location shown on site map ☒ Erosion not evident
   Areal extent _____ Depth _____
   Remarks : _____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
   Areal extent _____ Depth _____
   Remarks : _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
   Remarks: _____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
   Areal extent: _____ Height: _____
   Remarks: _____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent _____
   ☐ Ponding ☐ Location shown on site map Areal extent _____
   ☐ Seeps ☐ Location shown on site map Areal extent _____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent _____
   Remarks: _____

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent: _____
Remarks: _____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks: Two gas vents on non-hazardous cell and one gas vent on hazardous cell.

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks: _____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒N/A

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
   Areal extent _____ Depth _____
   Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☒ Vegetation does not impede flow
   Areal extent _____ Type _____
   Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent _____ Depth _____
   Remarks: Refer also to the photographic record.

4. **Discharge Structure** ☒ Functioning ☐ N/A
   Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

C. Treatment System ☐ Applicable ☒ N/A

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. **Monitoring Wells** (natural attenuation remedy)
   ☒ Properly secured/locked ☒ Functioning ☒ Good condition
   ☒ All required wells located ☐ Needs maintenance
   Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

Remarks: _____

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The landfill cells were closed prior to the Record of Decision (ROD) in accordance with requirements of the Resource Conservation and Recovery Act and following closure plans approved by PADEP and USEPA. Remedial action objectives identified in the ROD include: 1) minimize the potential for future migration of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) , and metals in groundwater and 2) restore groundwater in glacial till and bedrock aquifers to beneficial use and to levels that are protective of human health and the environment, as soon as practicable, through natural attenuation. The selected remedy is monitored natural attenuation and institutional controls. The institutional controls include: 1) an agreement with Coolbaugh Township to notify TYAD of any new construction that will require potable water, which ensures that new wells are not placed in areas of known or suspected contamination, 2) prohibition (in the TYAD Master Plan) of on-post drinking water well construction in the area of OU-5, 3) on-going public education regarding potential hazards associated with consumption of contaminated groundwater in OU-5, and 4) presenting the long-term monitoring results to all TYAD employees in the installation newspaper.

Site inspection observations indicate that new potable water supply wells have not been constructed in the area of OU-5. Long-term monitoring results have not been published in the installation newspaper and the results of the 2016 sampling should be reported once they are finalized.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Monitoring consists of annual groundwater sampling for Target Compound List (TCL) VOCs, TCL SVOCs, total cyanide, and total and dissolved metals. Prior monitoring (i.e. before 2007) was conducted semi-annually. The status of institutional controls has been reviewed during previous five-year reviews conducted in 2002, 2007, and 2012.

No issues were identified related to the O&M at OU-5.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None. The rationale used to determine the number of wells to be sampled during each round is based on the wells classification from the last round of sampling (above MCLs, below MCLs, not sampled, or no detections) and subsequent discussions with USEPA, the United States Army, and EA.

Five-Year Review Site Inspection Checklist
Tobyhanna Army Depot OU-5 (TBAD-001)

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ATTACHMENT 5

Photographic Record

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PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-1 Areas A and B

Photo No. 1
(21-July-2016)

Description:

View of new buildings in Area A that were built with passive sub-slab vapor vent systems.

Photo No. 2
(21-July-2016)

Description:

View looking north across Area A showing a groundwater monitoring well used in the long-term monitoring of OU-1.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-1 Area A and B

Photo No. 3
(21-July-2016)

Description:

View of a monitoring well at Area A used to monitor groundwater.

Photo No. 4
(21-July-2016)

Description:

View northwest across Area A.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-1 Areas A and B

Photo No. 5
(21-July-2016)

Description:

View southwest across a baseball field in Area A.

Photo No. 6
(21-July-2016)

Description:

View of groundwater monitoring wells to the south of Area A.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-1 Areas A and B

Photo No. 7
(21-July-2016)

Description:

View looking southwest at Area B.

Photo No. 8
(21-July-2016)

Description:

View of excavated section of Area B and a groundwater monitoring well.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-4 UXO Area

Photo No. 9
(21-July-2016)

Description:

View along the north side of the UXO Area which shows an example of the fencing that encloses the area.

Photo No. 10
(21-July-2016)

Description:

Example of damaged fencing that was schedule to be repaired the following week.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-4 UXO Area

Photo No. 11
(21-July-2016)

Description:

View of fencing around the Air Defense Radar Facility within OU-4 to restrict access to the rest of the UXO Area.

Photo No. 12
(21-July-2016)

Description:

View of the northwest corner of the UXO Area from the outside.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-5 Inactive Sanitary Landfill

Photo No. 13
(21-July-2016)

Description:

View looking north at controlled access point along unused railway at OU-5.

Photo No. 14
(21-July-2016)

Description:

View of railways and fencing along the west side of OU-5.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-5 Inactive Sanitary Landfill

Photo No. 15
(21-July-2016)

Description:

View looking south across the landfill cap.

Photo No. 16
(21-July-2016)

Description:

View looking southeast across the landfill cap.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-5 Inactive Sanitary Landfill

Photo No. 17
(21-July-2016)

Description:

Target used by the Air Defense Radar Facility on the OU-5 landfill cap.

Photo No. 18
(21-July-2016)

Description:

One of the two gas vents located in the non-hazardous cell.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-5 Inactive Sanitary Landfill

Photo No. 19
(21-July-2016)

Description:

View of mounded hazardous waste cell and drainage way between cells.

Photo No. 20
(21-July-2016)

Description:

View of monitoring well and sewer cover in the drainage way between the hazardous and non-hazardous waste cells.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-5 Inactive Sanitary Landfill

Photo No. 21
(21-July-2016)

Description:

View looking east with the hazardous waste cell to the right of the photograph.

Photo No. 22
(21-July-2016)

Description:

View of flush mounted monitoring well in road to the southwest of landfill.

PHOTOGRAPHIC RECORD
Tobyhanna Army Depot

OU-5 Inactive Sanitary Landfill

Photo No. 23
(21-July-2016)

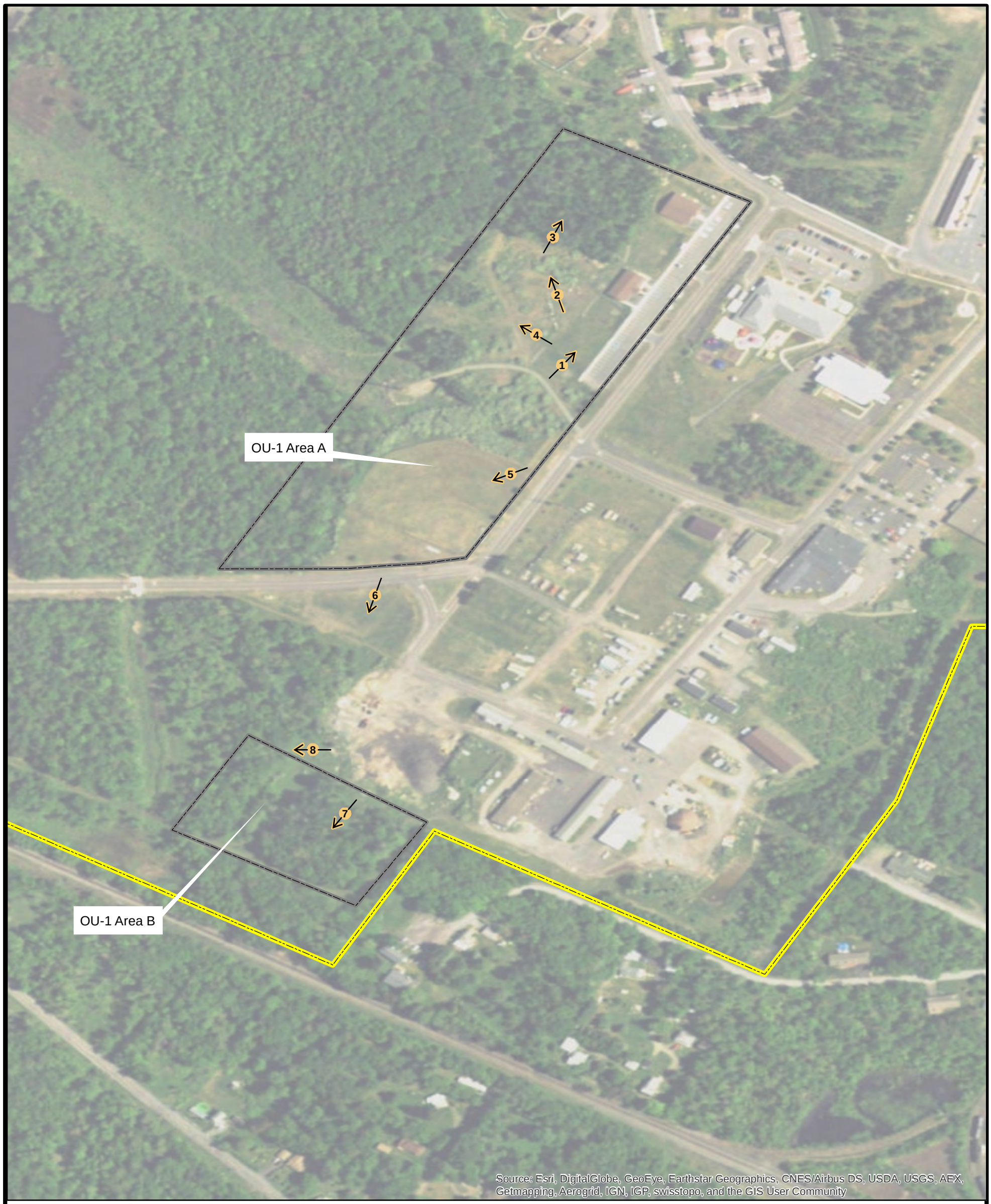
Description:

View looking north across landfill cap.

Photo No. 24
(21-July-2016)

Description:

Gas vent located on hazardous waste cell.



Photos

Institutional Control Boundary

Tobyhanna Army Depot Boundary

N
W
E
S

0 500 Feet

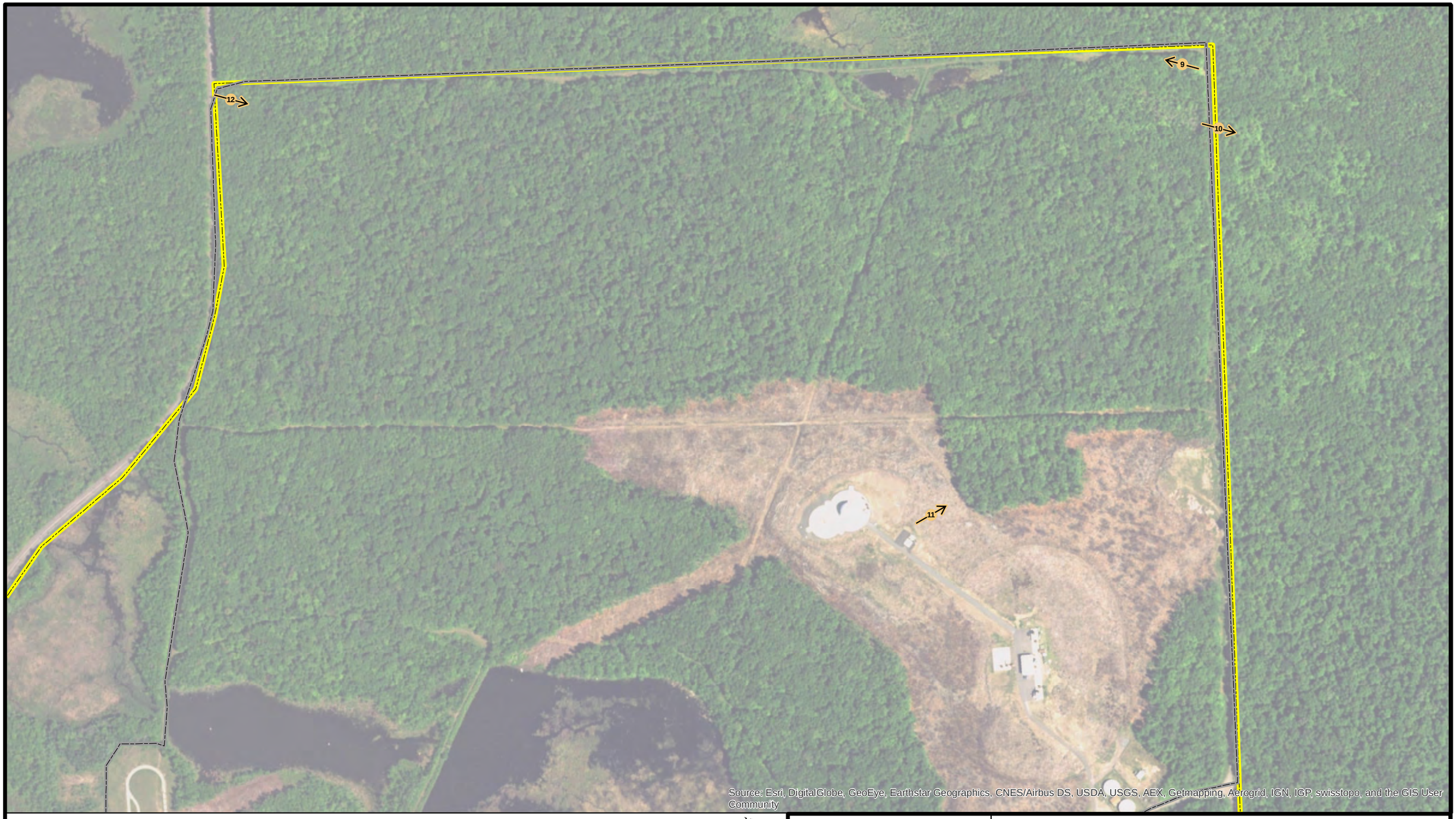
US Army Corps of Engineers
Buffalo District

Site Inspection Photograpic Record
OU-1 Areas A and B

Document Name: OU1_PhotoLoc.mxd
Drawn By: H5TDEEMP
Date Saved: 03 Oct 2016
Time Saved: 9:51:33 AM

Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

FIGURE A5-1



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Photos

Institutional Control Boundary

Tobyhanna Army Depot Boundary

N
W
E
S

0 250 500 1,000
Feet

US Army Corps of Engineers
Buffalo District

Document Name: OU4_PhotoLoc.mxd
Drawn By: H5TDEEMP
Date Saved: 03 Oct 2016
Time Saved: 10:32:00 AM

Site Inspection Photographic Record
OU-4 UXO Area

Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

Figure A5-2

Photos

Institutional Control Boundary

Tobyhanna Army Depot Boundary

N
W
E
S

0 250 500 Feet

US Army Corps of Engineers
Buffalo District

Site Inspection Photographic Record
OU-5 Inactive Sanitary Landfill

Document Name: OU5_PhotoLoc.mxd
Drawn By: H5TDEEMP
Date Saved: 03 Oct 2016
Time Saved: 9:48:12 AM

Five Year Review
Tobyhanna Army Depot
Tobyhanna, PA

FIGURE A5-3

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ATTACHMENT 6

Interview Records

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INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *1015*	**Date:** *1/9/2017*
Type: ☐ Telephone ☐ Visit ☒ Other **Location of Visit:** *Not applicable*		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: *Laura Allen*	**Title:** *Project Engineer*	**Organization:** *US Army Corps of Engineers, Buffalo District*

Individual Contacted:

Name: *Matthew Argust*	**Title:** *Environmental Restoration Manager*	**Organization:** *TYAD*
Telephone No: *(570) 615-6594* **E-Mail Address:** *matthew.j.argust.civ@mail.mil*	**Street Address:** *11 Hap Arnold Boulevard* **City, State, Zip:** *Tobyhanna, PA 18466*	

Summary Of Conversation

General Questions

1. What is your role and responsibilities for this project?
   Installation Restoration Program Manager.
2. What is the current status of the remedial actions (i.e. budget and schedule)?
   Remedial actions are ongoing at OU-1 and OU-5 with Long Term Monitoring with Land Use Controls at OU-4. All operations are funded under the DERP.
3. Are the remedies functioning as expected? How well are the remedies performing?
   Remedy at OU-1 was projected to be near complete at present at the time the remedy was originally selected, however, the remedy is functioning as it should based on current data of similar sites. OU-5 did have some unexpected fluctuations in the levels of the contaminants of concern. A Remedy Effectiveness study was performed based on comments from the last five year review and is in the last stage of becoming finalized. OU-4's LUCs are functioning well and construction of several new sites in the area have allowed for subsequent sweeps and removal of Unexploded Ordnance, lowering the overall risk associated with the site.
4. Have any problems been encountered that required or will require changes to the Record of Decision documents?
   No problems have been encountered that will require a change to the RODs. There is a potential pending the outcome of the Remedy Effectiveness Study for OU-5 to change its ROD but this is not anticipated at this time.
5. Are maintenance and monitoring costs available for 2012 to 2016?
   Yes
6. Have there been any complaints, violations, or other incidents related to the sites that required a response by your office? If so, please give details of the events and results of the responses.
   None since I took over as IRM in 2014 and there we none noted by the former IRM during the scope of this five year review.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *1015*	**Date:** *1/9/2017*

Operable Unit 1 (Areas A and B)

7. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
   It was discussed during the quarterly project meeting with the regulators to decommission some of the wells in the monitoring well network that have not been sampled in some time and to properly close them out. I think it would be a good idea to look further into which wells we should decommission and set a schedule to complete.
8. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?
   OU-1 is inspected on a monthly schedule. Some areas are inaccessible during the winter months and is annotated on the inspection when such conditions occur. The inspections are up to date and filed in the Environmental Branch Offices.
9. Have there been significant changes in the monitoring requirements, maintenance schedules, or sampling routines in the last five-years? If so, do they affect the remedy?
   There was a change in contractors for monitoring, maintenance and sampling but there has been no notable affect to the remedy.
10. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.
    Yes, Original drinking water wells of affected residents placed on the water supply system have been used as monitoring and sample locations and some of the equipment to operate these wells are beginning to fail. There has also been change of ownership of one residential sampling location (R1-94) that has proven difficult to reestablish Rights of Entry for sampling.
11. Have there been opportunities to optimize monitoring or maintenance efforts? If so, describe the changes and the resultant cost savings and/or improved efficiency.
    Two monitoring wells were decommissioned as a result of construction activity and having had no sampling results above the MCL.
12. Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?
    Yes
13. Has there been any community concerns regarding the site or its operation and administration? If yes, please give details.
    No
14. Has any other information come to light that would call into question the protectiveness of the remedy?
    No
15. Have groundwater monitoring results been presented to TYAD in the Tobyhanna Reporter?
    No, drinking water samples are post on the internal TYAD webpage and monitoring well sampling is announced through status updates through the command staff meetings and posted in the minutes. The minutes are reviewed at all organizational levels on a weekly basis. Any interested employees can request a copy of the results.
16. Has the right of entry for property R1-94 been re-established? If not, are entry rights being pursued?
    The current owners of the property live out of state and cannot be easily contacted. There was progress on getting the ROE reestablished but turnover in the local Corps of Engineers Real Estate Office halted this. The property is up for sale again and the contractor is working with the real estate agent for access until a request for Right of Entry can be made to the new property owners.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *1015*	**Date:** *1/9/2017*

17. Has the monitored natural attenuation remedy been reevaluated since the previous five-year review? If yes, please give details.
    Yes, it was re-evaluated and results will be part of the 2016 Annual Performance Evaluation for OU-1
18. Was 1,1,1-trichloroethane previously used, stored or disposed of at OU-1?
    Yes during installation construction and early operation during the 1950's.

Operable Unit 4

19. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
    Continue evaluation and potential removal action to reduce the size of this operable unit.
20. Have there been any significant changes in the inspection and maintenance requirements or schedules since the last five years? If so, please describe changes and impacts.
    No. OU-4, is all or at least partially inspected on a monthly schedule. Some areas are inaccessible during the winter months and is annotated on the inspection when such conditions occur. The fenceline for OU-4 is spot checked throughout the year with 100% inspection of the fence completed within the year. OU-4 also receives an annual inspection by contract and repairs are made to damaged areas and includes clearing the fence line of vegetation.
21. Has there been any community concerns regarding the site or its operation and administration? If so, please give details.
    None since I took over as IRM in 2014 and there we none noted by the former IRM during the scope of this five year review.
22. Has any other information come to light that would call into question the protectiveness of the remedy?
    No

Operable Unit 5

23. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
    No.
24. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?
    Yes. Monthly inspections of area and monitoring wells. Monthly inspections are up to date.
25. Have there been significant changes in the monitoring requirements, maintenance schedules, or sampling routines since start-up? If so, do they affect the remedy?
    No.
26. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.
    Some issues with vegetation control following the 2013 sequestration. Environmental Branch coordinated with maintenance personal on proper schedule of vegetation control to not cause impact to the landfill caps.
27. Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?
    A remedy assessment was completed in the summer of 2016 and is being reviewed by the EPA.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *1015*	**Date:** *1/9/2017*

28. Have there been opportunities to optimize monitoring or maintenance efforts? If so, describe the changes and the resultant cost savings and/or improved efficiency.
    During this period, maintenance of well heads was incorporated into the well sampling contract.
29. Has there been any community concerns regarding the site or its operation and administration? If yes, please give details.
    None.
30. Has any other information come to light that would call into question the protectiveness of the remedy?
    No.
31. Have trichloroethene concentration trends in bedrock wells been evaluated in accordance with recommendations in the last five-year review? If yes, please give details.
    A remedy assessment was completed in the summer of 2016 and is being reviewed by the EPA.
32. Has the monitored natural attenuation remedy been reevaluated since the previous five-year review? If so, please give details A remedy assessment was completed in the summer of 2016 and is being reviewed by the EPA.
33. Have groundwater monitoring results been presented to TYAD in the Tobyhanna Reporter?
    No, drinking water samples are post on the internal TYAD webpage and monitoring well sampling is announced through status updates through the command staff meetings and posted in the minutes. The minutes are reviewed at all organizational levels on a weekly basis. Any interested employees can request a copy of the results.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *Received: 1230*	**Date:** *Received: 8 Dec 2016*
Type: ☐ Telephone ☐ Visit ☒ E-mail **Location of Visit:** *Not applicable*		☒ Incoming ☐ Outgoing	

Contact Made By:

Name: *Laura Allen*	**Title:** *Project Engineer*	**Organization:** *US Army Corps of Engineers, Buffalo District*

Individual Contacted:

Name: *Mike Parrent*	**Title:** Acting Chief	**Organization:** *TYAD*
Telephone No: *570-615-6105* **E-Mail Address:** *Michael.L.Parrent.civ@mail.mil*	**Street Address:** *11 Hap Arnold Boulevard* **City, State, Zip:** *Tobyhanna, PA 18466*	

Summary Of Conversation

General Questions

1. What is your role and responsibilities for this project?
   Acting Chief of the Environmental Branch and backup Installation Restoration Program manager.
2. What is the current status of the remedial actions (i.e. budget and schedule)?
   Remedial actions ongoing and fully funded.
3. Are the remedies functioning as expected? How well are the remedies performing?
   Remedies as a whole are performing as expected. However, we are investigating the landfill as contaminant levels did not decrease over the past two years.
4. Have any problems been encountered that required or will require changes to the Record of Decision documents?
   None I am aware of.
5. Are maintenance and monitoring costs available for 2012 to 2016?
   Yes they were
6. Have there been any complaints, violations, or other incidents related to the sites that required a response by your office? If so, please give details of the events and results of the responses.
   Not in the past 5 years.

Operable Unit 1 (Areas A and B)

7. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
   No
8. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?
   Yes, Areas of concern are inspected monthly and a record placed into our files.
9. Have there been significant changes in the monitoring requirements, maintenance schedules, or sampling routines in the last five-years? If so, do they affect the remedy?
   No

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *Received: 1230*	**Date:** *Received: 8 Dec 2016*

10. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.
    No, just repair work.
11. Have there been opportunities to optimize monitoring or maintenance efforts? If so, describe the changes and the resultant cost savings and/or improved efficiency.
    Two monitoring wells were decommissioned as a result of construction activity and having had no sampling results above the MCL.
12. Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?
    Yes
13. Has there been any community concerns regarding the site or its operation and administration? If yes, please give details.
    No
14. Has any other information come to light that would call into question the protectiveness of the remedy?
    No
15. Have groundwater monitoring results been presented to TYAD in the Tobyhanna Reporter?
    No
16. Has the right of entry for property R1-94 been re-established? If not, are entry rights being pursued?
    Matt is working on that
17. Has the monitored natural attenuation remedy been reevaluated since the previous five-year review? If yes, please give details.
    No
18. Was 1,1,1-trichloroethane previously used, stored or disposed of at OU-1?
    In the early 50's

Operable Unit 4

19. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
    Consider UXO removal through entire area.
20. Have there been any significant changes in the inspection and maintenance requirements or schedules since the last five years? If so, please describe changes and impacts.
    No.
21. Has there been any community concerns regarding the site or its operation and administration? If so, please give details.
    No.
22. Has any other information come to light that would call into question the protectiveness of the remedy?
    No

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *Received: 1230*	**Date:** *Received: 8 Dec 2016*

Operable Unit 5

23. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
    No.
24. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?
    Yes. Monthly inspections of area and monitoring wells. Yes, up to date.
25. Have there been significant changes in the monitoring requirements, maintenance schedules, or sampling routines since start-up? If so, do they affect the remedy?
    No.
26. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.
    No.
27. Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?
    Just completed a remedy assessment. Results not yet in.
28. Have there been opportunities to optimize monitoring or maintenance efforts? If so, describe the changes and the resultant cost savings and/or improved efficiency.
    During this period, maintenance of well heads was incorporated into the well sampling contract.
29. Has there been any community concerns regarding the site or its operation and administration? If yes, please give details.
    None.
30. Has any other information come to light that would call into question the protectiveness of the remedy?
    No.
31. Have trichloroethene concentration trends in bedrock wells been evaluated in accordance with recommendations in the last five-year review? If yes, please give details.
    Yes, Remedy assessment completed, awaiting results.
32. Has the monitored natural attenuation remedy been reevaluated since the previous five-year review? If so, please give details
    Currently underway.
33. Have groundwater monitoring results been presented to TYAD in the Tobyhanna Reporter?
    Drinking water monitoring results are published on the depot intranet home page annually.

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INTERVIEW RECORD

Site Name: *Tobyhanna Army Depot (TYAD)*		**EPA ID No.:** *PA5213820892*	
Subject: *Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*		**Time:** *11:14am*	**Date:** *10/25/16*
Type: ☐ Telephone ☐ Visit ☒ Other **Location of Visit:** *Not applicable*		☐ Incoming ☒ Outgoing	

Contact Made By:

Name: *Laura Allen*	**Title:** *Project Engineer*	**Organization:** *US Army Corps of Engineers, Buffalo District*

Individual Contacted:

Name: *Lorie Baker*	**Title:** *NPL Coordinator/ RPM/SAM*	**Organization:** *USEPA*
Telephone No: *(215) 814-3355* **E-Mail Address:** *Baker.lorie@epa.gov*	**Street Address:** *1650 Arch Street* **City, State, Zip:** *Philadelphia, PA 19103*	

Summary Of Conversation

Operable Unit 1 (Areas A and B)

1. What is your overall impression of the project?
   My overall impression is that the contaminants remaining at Areas A and B are in very low concentrations and that natural attenuation has been working. However, when the contaminants have been at very low concentrations for such a long period of time, I would like to see if there is anything that can be done to accelerate the natural attenuation process and get the concentrations consistently below MCLs.
2. Do you believe the remedy is functioning as expected? How well do you feel the remedy is performing?
   The remedy is functioning as expected, but as stated above, I would like to see the process accelerated so that we can achieve cleanup goals faster. It seems that the attenuation has stalled because the concentrations are so low.
3. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
   We should be receiving a report sometime soon from the Army evaluating the remedy and providing recommendations on what might be done to expedite the process. I am hoping that the report provides some legitimate recommendations. I would have liked EPA and PADEP to be more involved in this report process. We should have been more involved in the planning process and providing input as the report was being drafted. The report is also to recommend how we close out the ROD (i.e., how many below MCL sampling events must there be before remediation goals are met.) This information was not included in the ROD.
4. Has there been routine communication or activities (site visit, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results?
   Because the site is in 5 year review status and there is not an active remediation ongoing, there has not been routine communication; however, the Army project manager has started to schedule quarterly meetings which will help to keep the regulators up to speed with ongoing activities.
5. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, provide details of the events and results of the responses.
   A private citizen had written a letter to President Obama regarding environmental issues near his property. In his letter, he did blame TYAD for some issues; however, those claims were unfounded.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *11:14am*	**Date:** *10/25/16*

6. Has any information come to light that could call into question the protectiveness of the remedy?
   No

7. Do you feel well informed about the site's activities and progress?
   With re-establishment of quarterly meetings, I will feel better informed.

Operable Unit 4

8. What is your overall impression of the project?
   The Army does a great job with keeping the fence and signage maintained. They also have been able to clear areas within the OU that have been re-developed.

9. Do you believe the remedy is functioning as expected? How well do you feel the remedy is performing?
   The remedy is functioning as expected and as far as I am aware there have been no incidents of trespassers in the area.

10. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
    I would like to see the area cleared as USACE did in the State Park and gamelands although it is very cost prohibitive.

11. Has there been routine communication or activities (site visit, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results?
    We typically take a drive around the fence during the 5 year reviews, but other than that, there is not much to do unless a portion of the OU is to be redeveloped. Then EPA will be involved in that redevelopment plan, usually by means of reviewing the Environmental Impact Statement.

12. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, provide details of the events and results of the responses.
    No.

13. Has any information come to light that could call into question the protectiveness of the remedy?
    No

14. Do you feel well informed about the site's activities and progress?
    Yes.

Operable Unit 5

15. What is your overall impression of the project?
    As with OU1, the risk is being managed and it appears that natural attenuation has resulted in the lowering of contaminant concentrations within the plume area.

16. Do you believe the remedy is functioning as expected? How well do you feel the remedy is performing?
    Yes, the remedy is functioning as expected; however, as with OU-1, if there is anything we could do to speed up the attenuation process so that we can meet our remedial goals sooner, I would like to see it put in place.

17. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
    Once again, as with OU1, there should be a report coming evaluating the remedy and providing recommendations as to how it could be more efficient. We had requested this evaluation as part of the last five year review and it seems to be taking a long time to get the report, into which EPA and PADEP have not had much input.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:** *11:14am*	**Date:** *10/25/16*

18. Has there been routine communication or activities (site visit, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results?
Because the site is in 5 year review status and there is not an active remediation ongoing, there has not been routine communication; however, the Army project manager has started to schedule quarterly meetings which will help to keep the regulators up to speed with ongoing activities.

19. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, provide details of the events and results of the responses.
No

20. Has any information come to light that could call into question the protectiveness of the remedy?
No

21. Do you feel well informed about the site's activities and progress?
Other than what has been mentioned previously about the remedy re-evaluation, we discuss the site during our quarterly meetings.

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INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:**	**Date:** *9 January 2017*
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:** *Not applicable*		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: *Laura Allen*	**Title:** *Project Engineer*	**Organization:** *US Army Corps of Engineers, Buffalo District*

Individual Contacted:

Name: *Chris Schroer*	**Title:** Deputy Project Manager	**Organization:** *EA Engineering, Science and Technology*
Telephone No: *315-565-6565* **E-Mail Address:** *cschroer@eaest.com*	**Street Address:** *6712 Brooklawn Parkway, Suite 104* **City, State, Zip:** *Syracuse, New York 13211*	

Summary Of Conversation

Operable Unit 1 (Areas A and B)

1. What is your involvement with the project?

   Scheduling/coordinating field events, reviewing analytical data, and preparing/reviewing annual performance evaluation reports.

2. Is the remedy functioning as expected? How well is the remedy performing?
   The remedy to protect human health is functioning as expected. Potable water is provided to residents downgradient of the impacted area is the IRM. Long term MNA is acceptable as concentrations are generally decreasing. The expected MNA timeline is likely to continue longer than originally expected.

3. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?

   No exit strategy was established with the remedial design.

4. Is there a monitoring plan and/or sampling plan for the site? If yes, describe the scope of each document and how they are implemented.
   There is a UFP-QAPP and Field Sampling Plan that was developed prior to EA assuming the responsibility to complete the RA(O). The document describes sample locations, field sampling methods, analyses, and quality control.

5. How often are you or your staff on site? Describe your site activities.
   Annually to twice per year depending on contract needs.

6. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?

   TYAD performs quarterly inspections for the AOC. Results from these inspections are included with the Annual Performance Evaluation (APE). EA completes an annual inspection in conjunction with the field sampling event and observations are provided in the APE.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:**	**Date:** *9 January 2017*

7. Have there been significant changes in the monitoring requirements, maintenance schedules, or sampling routines since start-up? If so, do they affect the remedy?

   There have been no significant changes to the monitoring requirements. SVOCs and Cyanide have been removed from the sampling requirements as there have been no detections.

8. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.

   No.

9. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
   An optimized exit strategy will be included in the 2016 APE and recommendations to reduce sampling points and analyses.

10. Has an exit strategy been developed for groundwater monitoring at OU-1? If yes, please give details.
    Please see response to question 9.

11. Has the monitored natural attenuation remedy been reevaluated since the previous five-year review? If yes, please give details.
    The MNA remedy is evaluated during each APE. However, no recommendations have been made to alter the remedy significantly.

12. Has any information come to light that could call into question the protectiveness of the remedy?
    No.

Operable Unit 4

13. What is your involvement with the project?
    Please see response to Question 1.

14. Is the remedy functioning as expected? How well is the remedy performing?
    Yes, the remedy is prevent access to the area from unauthorized personnel.

15. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
    No.

16. Is there a monitoring plan and/or sampling plan for the site? If yes, describe the scope of each document and how they are implemented.
    No environmental media are monitored or sampled at the site.

17. How often are you or your staff on site? Describe your site activities.
    Annually at minimum and often two to three times in order to maintain the effectiveness of the fence.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:**	**Date:** *9 January 2017*

18. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?
TYAD performs quarterly inspections for the AOC. Results from these inspections are included with the Annual Performance Evaluation (APE). EA completes an annual inspection in conjunction with the field sampling event and observations are provided in the APE.

19. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.
No. The fence required significant repairs in 2015 and work going forward is expected to be limited in scope and cost.

20. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
No. The fence is a passive barrier that requires occasional maintenance.

21. Has any information come to light that could call into question the protectiveness of the remedy?
No.

Operable Unit 5

22. What is your involvement with the project?
Please response to question 1.

23. Is the remedy functioning as expected? How well is the remedy performing?
Yes, although concentrations seemingly experienced a rebound, it is likely that this occurred as a result of changing sampling methods from one that resulted in degassing and concentrations biased low to the USEPA low flow methodology.

24. Do you have any comments, suggestions, or recommendations regarding the project (i.e. design, construction documents, constructability, management, regulatory agencies, etc.)?
No.

25. Is there a monitoring plan and/or sampling plan for the site? If yes, describe the scope of each document and how they are implemented.
There is a UFP-QAPP and Field Sampling Plan that was developed prior to EA assuming the responsibility to complete the RA(O). The document describes sample locations, field sampling methods, analyses, and quality control.

26. How often are you or your staff on site? Describe your site activities.
Annually to twice per year depending on contract needs.

27. Are routine inspections performed and records maintained? If so, describe how they are performed and their frequency. Is the reporting up to date?
TYAD performs quarterly inspections for the AOC. Results from these inspections are included with the Annual Performance Evaluation (APE). EA completes an annual inspection in conjunction with the field sampling event and observations are provided in the APE.

INTERVIEW RECORD

Site Name:	*Tobyhanna Army Depot (TYAD)*	**EPA ID No.:** *PA5213820892*	
Subject:	*Forth Five-Year Review of Remedial Actions Conducted at Operable Unit 1 (Areas A and B), Operable Unit 4, and Operable Unit 5*	**Time:**	**Date:** *9 January 2017*

28. Have there been significant changes in the monitoring requirements, maintenance schedules, or sampling routines since start-up? If so, do they affect the remedy?
    There have been no significant changes to the monitoring requirements. SVOCs and Cyanide have been removed from the sampling requirements as there have been no detections.

29. Have there been unexpected monitoring/maintenance difficulties or increased costs at the site since start-up? If so, please give details.
    No.

30. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
    An optimized exit strategy will be included in the 2016 APE and recommendations to reduce sampling points and analyses.

31. Has the monitored natural attenuation remedy been reevaluated since the previous five-year review? If yes, please give details.
    The MNA remedy is evaluated during each APE. However, no recommendations have been made to alter the remedy significantly.

32. Have the trichloroethene concentration trends in bedrock wells been evaluated in accordance with recommendations in the last five-year review? If yes, please give details.
    Yes. A remedy effectiveness evaluation report was prepared in December 2016 and submitted to regulators for concurrence prior to being finalized. The conclusion of the report was that increasing TCE trends were the result of changing sampling methodologies and analytical concentrations should not be compared to concentrations using a significantly different sampling method. Comparison of TCE results through 2016 indicate a decreasing trend.

33. Has any information come to light that could call into question the protectiveness of the remedy?
    No.

ATTACHMENT 7
ARAR Evaluation

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ARAR EVALUATION

BACKGROUND

Section 121 (d)(2)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) specifies that remedial actions must meet Federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). The NCP, 40 Code of Federal Regulations (CFR) 300.430(f)(1)(ii)(B) requires on-site remedial actions conducted under CERCLA attain, or waive, legally applicable ARARs under federal or more stringent state environmental or facility citing laws identified at the time of the ROD signature. ARARs are those standards, criteria, or limitations promulgated under federal or more stringent state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. To-Be-Considered (TBC) criteria are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of human health or the environment.

The final remedy selected for a site should be designed to meet all chemical-specific, action-specific, and location-specific ARARs and consider all TBCs. Chemical-specific ARARs are health- or risk-based numerical values for individually listed contaminants in specific media. Action-specific ARARs are technology- or activity-based limitations or requirements that are selected to accomplish a remedy. Location-specific ARARs are restrictions placed on the concentration of chemicals or conduct of operations based on the location of a site.

OBJECTIVE

The Tobyhanna Army Depot (TYAD) is listed on the National Priorities List (NPL) [U.S. EPA ID PA5213820892]. TYAD consists of the following operable units (OUs).

- **OU 1 – Areas A and B located in the southeastern portion of TYAD**
- OU 2 – AOC #63 (former polychlorinated biphenyl (PCB) transformer substation)
- OU 3 – Two former hazardous waste facilities (Buildings 10-C and S-90)
- **OU 4 – AOC #55 (400-acre portion of the former 21,100-acre artillery range)**
- **OU 5 – Inactive Sanitary Landfill located on the western portion of TYAD**

This is the fourth five-year review of OUs 1, 4, and 5 at TYAD. In 1996, the Army and U.S. EPA signed no further action (NFA) records of decision (RODs) for OUs 2 [TYAD 1996a] and 3 [TYAD 1996b]. Therefore, CERCLA review of those sites is not required.

This evaluation was prepared to address Question B of the CERCLA five-year review, "Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?"

EVALUATION

OU 1

OU 1 is separated into two distinct areas; Areas A and B. Area A consists of trenches and pits that were excavated and used during the late 1950s and early 1960s for burning waste generated by TYAD. Area B is near the southeastern corner of TYAD and consists of a former drum-

staging area, which was used for temporary storage and disposal of building materials, and other wastes during construction of the existing facility.

In July 1995, the Army conducted a removal action of 2,089 cubic yards [note: 1,200 cubic yards was originally estimated] of VOC-contaminated soils in Area B to meet soil cleanup levels that were considered protective of groundwater (i.e., federal MCLs). Soils in Area A did not have contaminants at levels in excess of these soil cleanup levels [TYAD 1997, Weston 1998, and OHM 1996].

Soil cleanup levels developed by the Summers[1] (fate and transport analysis) model were:

	Area A	Area B
• TCE (mg/kg)	0.067	1.67
• PCE (mg/kg)	0.180	4.66

The Pennsylvania Land Recycling Act (Act 2) also had established soil cleanup levels at the time of the removal action:

- TCE (mg/kg) 2 mg/kg
- PCE (mg/kg) 2 mg/kg

Since the cleanup goal developed for PCE in soil by the Summers model (i.e., 4.66 mg/kg) was higher than the Act 2 soil standard for PCE (i.e., 2 mg/kg), the Act 2 standard of 2 mg/kg was used as the established cleanup level for the removal of PCE in Area B soils.

Therefore, the soil cleanup levels used for the 1995 removal action (below) were developed using the more stringent of the Pennsylvania Land Recycling Act (Act 2) standards and the site-specific analytical results of the Summers Model.

OU 1 Soil Cleanup Levels (1995 Removal Action)

	Area A	Area B
• TCE (mg/kg)	0.067	1.67
• PCE (mg/kg)	0.180	2.00

The current Pennsylvania Land Recycling Act (Act 2) soil cleanup levels, or medium-specific concentrations (MSCs), for the protection of groundwater[2] are:

- TCE (mg/kg) 0.5 mg/kg
- PCE (mg/kg) 0.5 mg/kg

The 1995 soil cleanup levels for TCE and PCE in Area A remain more stringent than the current Pennsylvania soil MSCs. However, the current Pennsylvania soil MSCs for PCE and TCE (i.e.

[1] The Summers model [Summers et al., 1980] is a simple mass balance that simulates the dilution of soil leachate in groundwater based on flow-averaged concentration resulting from the mixing of soil leachate with the underlying groundwater. The predicted groundwater concentration was used to back calculate the residual soil concentration that is protective of groundwater.

[2] Reference: Regulations for the Pennsylvania Land Recycling and Environmental Standards Act (Act 2) [Title 25, Pennsylvania Code Chapter 250, Administration of Land Recycling Program, August 27, 2016], Table 3b for Residential Used Aquifers with TDS ≤ 2500, 100xGW MSC.

0.5 mg/kg) are now more stringent than the 1995 soil cleanup levels for PCE and TCE in Area B (2.00 mg/kg and 1.67 mg/kg, respectively).

Table 2-1 of the OU 1 ROD [TYAD 1997] listed the post-1995 removal maximum contaminant concentrations in Area B as:

	Area B
• TCE (mg/kg)	0.56
• PCE (mg/kg)	0.88

Maximum post-1995 removal action residual concentrations of PCE and TCE in Area B soil are higher than the current Pennsylvania MSCs (soil-to-groundwater) (i.e. 0.5 mg/kg). Maximum residuals in soil remain protective of current Pennsylvania MSCs for direct contact[3], however.

In Attachment 8 of this Five-Year Review Report, these maximum detected post-1995 removal PCE and TCE soil concentrations were compared to current industrial and residential risk-based concentrations. As shown in Table A.8-4, the post-removal soil concentrations are lower than even the current residential risk-based concentrations. Therefore, the 1995 removal action remains protective against direct soil contact exposure pathways.

To determine whether the residual VOCs in soil are currently protective of groundwater, post-1995 removal action soil confirmation sample results in the Final Report for the Area "B" Soil Removal Action [OHM 1996] were reviewed.

According to the Executive Summary of the Final Removal Action Report for Area B [OHM 1996], "Risk based soil action levels of 1.667 mg/kg and 4.66 mg/kg of TCE and PCE respectively were established for the project." This appears to conflict with Section 2.2 of the OU 1 ROD [TYAD 1997] which indicates that although the Summers model predicted a soil cleanup goal of 4.66 mg/kg for PCE in Area B, that "the Act 2 standard of 2 mg/kg was used as the established cleanup level for PCE in soils at Area B."

Section 4.6 of the Final Removal Action Report for Area B [OHM 1996] indicated that "All initial excavation sample results were collected and analyzed from the floor and sidewalls of the excavation and analyzed at the on-site laboratory. When a sample was determined to contain concentration so TCE and PCE below their respective action levels" (i.e. 1.677 mg/kg and 4.66 mg/kg, respectively), "it was sent for off-site confirmatory analysis." Figure 1.1 and Appendix D of the Final Removal Action Report for Area B [OHM 1996] presents a table of and data for off-site analytical results for ten soil confirmation samples collected from the excavation bottoms.

Although, as indicated in Table 2-1 of the OU 1 ROD [TYAD 1997], the maximum post-1995 removal action residual concentrations of PCE and TCE in Area B soil are 0.88 mg/kg and 0.56 mg/kg, respectively, a majority of the remainder of the soil confirmation sample results (below)

[3] Reference: Regulations for the Pennsylvania Land Recycling and Environmental Standards Act (Act 2) [Title 25, Pennsylvania Code Chapter 250, Administration of Land Recycling Program, August 27, 2016], Table 3a for Residential Use.

were below the current Pennsylvania MSCs (soil-to-groundwater) of 0.5 mg/kg for both PCE and TCE.

Sample Number	Sample Depth (feet)	Sample Date (1995)	On-Site Analysis Date (1995)	Off-Site Confirmation Results TCE (mg/kg)	Off-Site Confirmation Results PCE (mg/kg)
W102C	6	7/17	7/18	0.006 U	0.006 U
W202D*	13	7/20	7/20	ND	ND
W203H	7	7/28	7/28	0.007 U	0.09
W302A	3	7/22	7/22	**0.56**	**0.88**
W305E	11	7/27	7/27	0.005 U	0.005 U
W306D	13	7/28	7/31	0.02	0.03
W404C	7	7/24	7/24	0.18	**0.66**
W405A	3	7/25	7/25	0.03	0.06
W502C	12	7/18	7/18	0.005 U	0.005 U
W505D	7	7/26	7/26	**0.68 U**	**0.68 U**
			Average	0.15	0.24

U = Non-Detect
Bold = Exceeds current Pennsylvania MSC (soil-to-groundwater) of 0.5 mg/kg for PCE and/or TCE

* No numerical values were listed in Appendix D of the Final Removal Action Report for Area B [OHM 1996] for the non-detects associated with sample number W202D. Detection limits of 0.01 mg/kg were assumed for these sample results when calculating the average.

The average post-1995 removal action residual concentrations of TCE and PCE in Area B soil (0.15 mg/kg and 0.24 mg/kg, respectively) are lower than the current Pennsylvania MSCs (soil-to-groundwater) (i.e. 0.5 mg/kg). Based upon this review, it was determined that residual VOCs in soil remain protective of groundwater.

Interim measures/institutional controls will remain in place until the VOC levels in groundwater are restored to concentrations below MCLs to prevent human exposure. Therefore, post-1995 removal action residuals will not impact protectiveness of the remedy.

The remedy selected for Areas A and B in the OU 1 ROD [TYAD 1997] consisted of the following:

- Natural attenuation and long-term monitoring of volatile organic compounds (VOCs) in groundwater;
- Institutional controls to prevent human consumption of groundwater until monitoring determines that controls are no longer necessary; and
- No further action for soil.

Section 10.2.1 of the OU 1 ROD [TYAD 1997] identifies the following chemical-specific ARARs for VOCs in OU 1 groundwater:

- National Primary Drinking Water Regulations [40 CFR 141.61]; and
- State (of Pennsylvania) Primary MCLs [Pa Code §109.202(a)(2) and (3)].

Additionally, the "Statewide Human Health Standards"[4] under the Land Recycling and Environmental Remediation Standards Act is identified as a TBC requirement.

Sections 10.2.2 and 10.2.3 of the OU 1 ROD [TYAD 1997] state that there are no federal or state action- or location-specific ARARs identified for OU 1.

The remediation goals (RGs) for VOCs in groundwater underlying Areas A and B were identified in Section 6.4 of the OU 1 ROD [TYAD 1997]. As summarized in Table A7-1, no groundwater standards have changed since the OU 1 ROD was signed.

The most recent groundwater sampling event in OU 1 was conducted in October 2015. According to Tables 2-4 and 2-5 of the 2015 annual performance evaluation report for OUs 1, 4, and 5 [EA 2016], only tetrachloroethylene (PCE) remains above its respective federal drinking water standard (i.e. MCL); in groundwater-monitoring well MW11. As indicated in Section 2.6 of the 2015 annual performance evaluation report [EA 2016], there have been few detects of PCE above the 5 µg/L MCL since the September 1994 sampling event. MW11 is the only monitoring well with detections consistently above the MCL.

The TYAD Master Plan, Section 4 Environmental Quality prohibits the construction of new drinking water wells in the plume of groundwater contamination is prohibited. However, groundwater contamination from Area B migrates off-site. Results of a non-parametric Mann-Kendall (MK) test summarized in Table 2-9 of the 2015 annual performance evaluation report [EA 2016].

As indicated in Section 2.7 of the 2015 annual performance evaluation report [EA 2016], results of the MK analysis showed generally decreasing TCE concentration trends at OU-1 Areas A and B, with no wells identified as having an increasing trend. It was noted that none of the groundwater wells sampled in the most recent sampling events (i.e. July and October 2015) exceeded the TCE remediation goal of 5 µg/L, as indicated in Table 2-4 of the 2015 annual performance evaluation report [EA 2016].

Since PCE was detected at low or non-detect concentrations in the majority of the wells in OU-1 Areas A and B, the results of the MK analysis indicate no trend for 11 of the 19 wells evaluated. The remainder of the groundwater wells demonstrated a stable or likely decreasing trend in PCE concentrations. It was noted that one of the groundwater wells (MW11) sampled in the past 5 sampling events (i.e. November 2011, October 2012, October 2013, July 2015, and October 2015) exceeded the PCE remediation goal of 5 µg/L, as indicated above and in Table 2-5 of the 2015 annual performance evaluation report [EA 2016]. However, Table 2-9 of the 2015 annual performance evaluation report [EA 2016] indicates that PCE concentrations in MW11 have a decreasing trend.

As stated in Section 2 of the Remedial Design Report for OU 1 [Weston 1998], users of the groundwater near TYAD will be protected against using water in excess of MCLs through the

[4] The "Statewide Human Health Standards", or medium-specific concentrations (MSCs), are found in regulations for the Pennsylvania Land Recycling and Environmental Standards Act (Act 2) [Title 25, Pennsylvania Code Chapter 250, Administration of Land Recycling Program, November 24, 2001] and were recently revised (August 27, 2016).

continued use of interim measures/institutional controls until the VOC levels in groundwater are restored to concentrations below MCLs. Additionally, there is an agreement with Coolbaugh Township Zoning Office to notify TYAD of new construction involving potable water to ensure new wells are not placed in areas of known or suspected contamination and will allow the resident to be connected to the TYAD potable water supply.

There are no new standards or performance requirements affecting the protectiveness of the remedy at OU 1.

OU 4

OU 4, also referred to as area of concern (AOC) #55, is the former Tobyhanna Artillery Range, which was used for artillery practice and machine gun training from 1912 until 1946. As such, there is a potential that unexploded ordnance (UXO) is present in OU 4.

The remedy selected for the former artillery range in the OU 4 ROD [TYAD 2000a] is institutional controls, which consist of the following:

- Physical controls – maintain barbed wire fence and signs around perimeter of OU 4;
- Security Patrols/Monitoring – to minimize trespassers onto OU 4;
- UXO support – use of explosives ordnance disposal (EOD) trained personnel to support any intrusive activities in OU 4;
- Propriety controls – deed restrictions'
- Public/employee education – information on the dangers of UXO; and
- Periodic review – CERCLA review every five years.

Section X of the OU 4 ROD [TYAD 2000a] indicates that there are no ARARs that address UXO contamination at inactive ranges.

The 2015 annual performance evaluation report [EA 2016] documents the latest annual performance evaluation of institutional controls at OU 4.

OU 5

OU 5 is defined as groundwater impacted by the inactive sanitary landfill (also referred to as AOC #1) that operated from 1963 to 1979.

The groundwater remedy identified in the OU 5 ROD [TYAD 2000b] consisted of the following:

- Natural attenuation and long-term monitoring of VOCs, semi-volatile organics (SVOCs), and metals; and
- Institutional controls to prevent human exposure to contaminated groundwater until monitoring data indicate that institutional controls are no longer necessary (i.e., groundwater remediation goals have been met).

Section X of the OU 5 ROD [TYAD 2000b] identifies the following chemical-specific ARAR for groundwater contaminants in OU 5:

- National Primary Drinking Water Regulations [40 CFR 141.61].

There are no federal or state action- or location-specific ARARs identified in the OU 5 ROD [TYAD 2000b].

The remediation goals (RGs) for VOCs, SVOCs, and metals in OU 5 groundwater were identified in Section VII of the OU 5 ROD [TYAD 2000b].

As summarized in Table A7-2, the only groundwater standard that has changed since the OU 5 ROD [TYAD 2000b] is arsenic. The USEPA drinking water standard for arsenic decreased from 50 to 10 µg/L on January 22, 2001 (effective February 2002; enforceable January 2006), following issuance of the OU 5 ROD [TYAD 2000b].

The most recent groundwater sampling event in OU 5 was conducted in October 2015. A total of 23 rounds of groundwater sampling have been conducted under the LTM requirements of the OU 5 ROD from February 2000 to October 2015.

According to Tables 4-3 (VOCs) and 4-4 (metals) of the 2015 annual performance evaluation report [EA 2016], PCE, TCE, vinyl chloride, arsenic, and barium were detected in groundwater above their respective federal drinking water standard. The current arsenic MCL of 10 µg/L was exceeded in the total arsenic groundwater samples from LF13 (21.0 J µg/L), LF22 (30.0 J µg/L), and LF23 (110.0 µg/L) and dissolved groundwater samples from LF13 (19.0 J µg/L), LF22 (36.0 J µg/L), and LF23 (100.0 µg/L).

According to the TYAD Master Plan, Section 4 Environmental Quality, prohibits the construction of new drinking water wells in the plume of groundwater contamination. Although arsenic is currently above the federal arsenic MCL in OU5 groundwater, the remedy is currently protective since the OU-5 ROD includes institutional controls to present exposure to contaminated groundwater until groundwater remediation goals are met. However, to ensure long-term protectiveness, an explanation of significant differences to the OU 5 ROD [TYAD 2000b] must be issued to adjust the arsenic groundwater RG from 50 to 10 µg/L.

Although groundwater contamination from Area B migrates off-site, Section 2 of the Remedial Design Report for OU 1 [Weston 1998] indicates that users of the groundwater near TYAD will be protected against using water in excess of MCLs through the continued use of interim measures/institutional controls until the COC levels in groundwater are restored to concentrations below MCLs. Additionally, there is an agreement with Coolbaugh Township Zoning Office to notify TYAD of new construction involving potable water to ensure new wells are not placed in areas of known or suspected contamination and will allow the resident to be connected to the TYAD potable water supply.

CONCLUSIONS

There are no newly promulgated or modified requirements of federal or state environmental laws that would change the current protectiveness of the remedies implemented at the TYAD. To ensure long-term protectiveness, an explanation of significant differences to the OU 5 ROD [TYAD 2000b] must be issued to adjust the arsenic groundwater RG/MCL from 50 to 10 µg/L.

REFERENCES

EA Engineering, Science, and Technology, Inc. (EA) 2016. *Draft Final 2015 Annual Performance Evaluation for Operable Units 1, 4, and 5*, June.

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Summers, K., S. Gherini, and C. Chen. 1980. *Methodology to Evaluate the Potential for Ground Water Contamination from Geothermal Fluid Releases*. EPA-600/7-80-117, U.S. EPA/IERL, Cincinnati, Ohio.

Tobyhanna Army Depot (TYAD) 2000a. *Record of Decision, Operable Unit #4, Tobyhanna Army Depot, Tobyhanna, Pennsylvania*. September.

TYAD 2000b. *Record of Decision, Operable Unit #5, Tobyhanna Army Depot, Tobyhanna, Pennsylvania*. September.

TYAD 1997. *Final Tobyhanna Army Depot Operable Unit 1 (Areas A and B) Record of Decision*. September.

TYAD 1996a. *Record of Decision, Operable Unit #2, Tobyhanna Army Depot, Tobyhanna,* Pennsylvania. September.

TYAD 1996b. *Record of Decision, Tobyhanna Army Depot, Operable Unit 3, Area of Concern (AOC) 37, Bldg 10-C and Area of Concern (AOC) 38, Bldg S-90, Tobyhanna,* Pennsylvania. August.

Weston 1998. *Final Remedial Design for Operable Unit 1 (Areas A and B), Tobyhanna Army Depot*, December.

Table A7-1 ARAR-Based Remediation Goals for OU 1 at the Tobyhanna Army Depot

Source Area	Media of Concern	Chemical of Concern	Groundwater Standards (ROD[a] / Federal MCL[b] / State MSC[c])	Units	Changes to ARAR since ROD?
OU 1 (Areas A and B)	Groundwater	Tetrachloroethene (PCE)	5 / 5 / 5	µg/L	No
		Trichloroethylene (TCE)	5 / 5 / 5		No
		Cis-1,2-dichloroethene (Cis-1,2 DCE)	70 / 70 / 70		No
		Vinyl Chloride (VC)	2 / 2 / 2		No

[a] Reference: *ROD for OU 1 at the Tobyhanna Army Depot* [TYAD 1997]
[b] Reference: *National Primary Drinking Water Regulations* [40 CFR 141.61]

[c] Reference: Regulations for the Pennsylvania Land Recycling and Environmental Standards Act (Act 2) [Title 25, Pennsylvania Code Chapter 250, Administration of Land Recycling Program, August 27, 2016], Table 1 for Residential Used Aquifers with TDS ≤ 2500

ARAR	applicable or relevant and appropriate requirement	TDS	total dissolved solids
MCL	Maximum Contaminant Level	TYAD	Tobyhanna Army Depot
MSC	Pennsylvania Medium-Specific Concentration	µg/L	micrograms per liter
OU	Operable Unit		
ROD	Record of Decision		

Table A7-2 ARAR-Based Remediation Goals for OU 5 at the Tobyhanna Army Depot

Source Area	Media of Concern	Chemical of Concern	Groundwater Standards (ROD[a] / Federal MCL[b])	Units	Changes to MCL since ROD?
OU 5 (Inactive Sanitary Landfill)	Groundwater	Barium	2,000 / 2,000	µg/L	No
		Arsenic	**50[c] / 10**		**Yes**
		Benzene	5 / 5		No
		Vinyl Chloride (VC)	2 / 2		No
		1,2-dichloropropane	5 / 5		No
		Tetrachloroethene (PCE)	5 / 5		No
		Trichloroethylene (TCE)	5 / 5		No
		Pentachlorophenol	1 / 1		No
		Bis(2-ethylhexyl)phthalate	6 / 6		No

[a] Reference: *ROD for OU 5 at the Tobyhanna Army Depot* [TYAD 2000b]
[b] Reference: *National Primary Drinking Water Regulations* [40 CFR 141.61]

c On January 22, 2001, U.S. EPA adopted a new standards for arsenic in drinking water of 10 µg/L, replacing the old standard of 50 µg/L. The actual arsenic MCL was 50 µg/L when the OU-5 ROD was issued (September 2000).

ARAR	applicable or relevant and appropriate requirement	ROD	Record of Decision
MCL	Maximum Contaminant Level	TYAD	Tobyhanna Army Depot
OU	Operable Unit	µg/L	micrograms per liter

ATTACHMENT 8

Risk Assessment and Toxicology Evaluation

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Risk Assessment and Toxicology Evaluation

This evaluation was prepared to address Question B of the statement of service, *"Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?"*

This is the fourth Five Year Review for the Tobyhanna Army Depot. Three operable units (OUs) are being evaluated as part of this Five Year Review. Each OU will be evaluated separately below.

OU-1

This OU is comprised of remediated soil contamination at Areas A and B, as well as VOCs in groundwater resulting from the soil contamination. Groundwater is used as a drinking water resource for the TYAD occupants as well as neighboring residents. The Army installed first an activated carbon treatment system and then an air stripper to treat the groundwater in order to make it suitable to drink. The Army also installed a waterline to nearby residents to provide potable water. A Record of Decision (ROD) for OU-1 was signed in September 1997. Following the third Five Year Review, an additional investigation of potential vapor intrusion pathway risks was performed. This Five Year Review evaluates toxicity and exposure factor values used to establish the original ROD cleanup levels, as well as those factor values considered in the 2012 vapor intrusion pathway report.

Human Health

Remedial action objectives were identified in the 1997 ROD as follows:

- Minimize the potential for future migration of VOC in groundwater, and
- Restore groundwater in the glacial till and bedrock aquifers to beneficial use and to levels protective of human health and the environment.

The 1997 ROD indicates that a previous interim remedial action addressed soil contamination, so the ROD focuses on groundwater cleanup. Table 2-1 of the 1997 ROD presents soil cleanup targets that were considered protective of groundwater using the EPA's maximum contaminant level (MCL) for drinking water. Note that although the Third Five Year Review (2012) indicates that "The confirmatory soil sample results will be reviewed based on current toxicity criteria as part of the re-evaluation of the OU-1 MNA remedy to be performed as part of the upcoming annual performance evaluation reports," the groundwater cleanup goals remain the MCLs. A review of the MCL is provided in Attachment 7.

Table 6-3 of the 1997 ROD provides toxicity criteria for human constituents of potential concern. The footnotes to that table indicate that the toxicity criteria were obtained from The EPA's 1992 database (Integrated Risk Information System, IRIS) or tables (Health Effects Assessment Summary Tables, HEAST).

Toxicity criteria updates are identified in Table A.8-1 (USEPA 2016b). Tables A.8-2 and A.8-3 provide current toxicity criteria for these constituents. All of the cleanup goals were developed based on ARARs and not risk-based concentrations, therefore, a compilation of toxicity criteria used to develop cleanup goals is not provided. A review of ARAR-based cleanup goals is provided in Attachment 7.

Table 2-1 of the 1997 ROD indicates that post removal-action residual concentrations of PCE and TCE in soil are lower than the values needed for groundwater protection based on a site-specific model ("Summer's model") and the Pennsylvania's Land Recycling Act 2 cleanup goals in place at the time. Any change in the Pennsylvania's Land Recycling Act 2 medium-specific soil concentrations for protection of groundwater may affect whether the soil removal action is still considered effective. This is discussed in Attachment 7. Toxicity criteria changes do not affect whether the soil removal action remains appropriate and effective for exposure to groundwater.

However, updates to the toxicity criteria may affect whether or not the earlier soil interim remedial action remains protective against direct soil contact exposure pathways. To evaluate this question, current USEPA regional risk-based soil screening levels for protection of human health (USEPA 2016) were compared to maximum detected concentrations of PCE and TCE in site soils following soil remedial action. As seen in Table A.8-4, current risk-based screening levels protective of hypothetical residential exposures are greater than the concentrations of PCE and TCE remaining in soils at the site. The current level of exposure of people to OU-1 soils at the TYAD is much less than residential exposure, therefore, there is no current risk from direct soil exposure pathways.

A vapor intrusion assessment was performed for OU-1 in 2012 (Weston 2012). This vapor intrusion assessment would have used the updates in risk methodology that were developed to characterize the inhalation pathway by the USEPA in 2009 (USEPA 2009). In addition, all the toxicity criteria updates listed in Table A.8-1 should have been incorporated into the indoor air risk-based screening levels used in the vapor intrusion assessment, since risk-based screening levels were obtained from an April 2012 Oak Ridge screening level table. (PCE toxicity criteria updates were posted to IRIS in February 2012.) This was verified by comparing current indoor air risk-based screening levels to those used in the vapor intrusion study report (Table A.8-5). Since the risk-based screening levels used in the 2012 vapor intrusion pathway study report remain valid, the conclusions of that report remain valid as well. This conclusion stated, "Based on multiple lines of evidence, it is not likely that the [vapor intrusion pathway] VIP from the OU-1 source areas or the related bedrock groundwater plume is a pathway of concern for these residences." There was an isolated detection of TCE in one home at 52 $\mu g/m^3$, but it was determined to not be related to an OU-1 source area or the related bedrock groundwater plume.

Two new on-site buildings recently built in Area A (2010 – 2012) were constructed using sub-slab vapor barriers and passive vapor ventilation systems to proactively mitigate against any potential vapor intrusion from contaminated groundwater.

Ecological Risk

Groundwater is typically not an exposure medium for ecological receptors unless it leaches to surface water. The ROD states, "Based on data obtained to date, VOCs at Areas A and B do not appear to be adversely impacting the surface water or sediment quality. Therefore, the Army does not plan to address surface water or sediment as part of this OU." No information has come to light indicating new impacts to surface water or sediment at this site.

Significant Finding

Yes, the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection are still valid. Updates in toxicity criteria for

COCs established in the ROD do not affect the protectiveness of either the soil or the groundwater exposure pathways. The Army continues to supply drinking water to affected residences and businesses. Vapor intrusion risks to off-site residents were evaluated in 2012 and the vapor intrusion pathway study conclusions, indicating that this pathway does not pose a risk, remain valid. No exposure to ecological receptors is expected.

OU-4

Human Health

The ROD for OU-4 was signed in 2000 and stipulates land use controls to prevent exposure of people to the unexploded ordnance (UXO). A risk assessment was performed according to "The Risk Assessment Procedures for Ordnance AD Explosive (OE) Site" (1994, reference no longer available), along with "MIL-STD 882c" (Department of Defense 1993) and Army Regulation 385-10, "The Army Safety Program" (Department of the Army 1988) (OU-4 ROD, Attachment 2). As described in the OU-4 ROD attachment, an Archive Search Report was performed in 1995, followed by a Public Health Assessment in 1997. Current USACE Guidance is outlined in Engineer Pamphlet 1110-1-18 Ordnance and Explosives Response, which was published in April 2000 (USACE 2000), and also Engineer Manual 200-1-15 Technical Guidance for Military Munitions Response Actions, published in October 2015 (USACE 2015). The Risk Assessment Procedure for Ordnance and Explosive sites specified in EP 1110-1-18 is virtually the same as that followed at OU-4 in 1994. Although the hazard assessment for munitions and explosives of concern outlined in EM 200-1-15 (which refers to the EPA's 2008 interim Munitions and Explosives of Concern Hazard Assessment protocols) results in a slightly different hazard scoring system, the overall process is the same and the conclusion on need for action would not differ under the newer hazard scoring system. There is no indication to update the risk assessment for UXO in OU-4. The remedial action was to prevent access and any activity occurring at the OU. It is assumed that any contact could lead to hazardous encounter, resulting in explosion. The ROD states, "Exposure to explosive chemical hazards or chemical warfare material is not anticipated because chemical munitions were not used at the depot." Therefore this remedial action was predicated on the potential explosive hazard at the OU, and chemical risks were not evaluated.

Ecological Risks

In 2012, the USACE began conducting a munitions explosives removal action in the State Park and State Game Lands that are adjacent to TYAD under the Defense Environmental Restoration Program of Formerly Used Defense Sites. That work is not under the scope of this Five Year Review. The OU-4 area of the TYAD is not being managed for ecological purposes.

Significant Finding

The exposure assumptions and remedial action objectives developed at the time of the remedy are still valid at OU-4. People are prevented from encountering UXO by the presence of the fence around OU-4. The OU-4 area of the TYAD is not being managed for ecological purposes. The adjacent property contains a State Park and Game Lands that are currently undergoing a munitions explosives removal action, which is under the purview of the Defense Environmental Restoration Program of Formerly Used Defense Sites, not this Five Year Review.

OU-5

The ROD for OU-5 was also signed in 2000. This OU comprises a sanitary landfill and groundwater contamination emanating from the landfill. Groundwater COCs were identified in

the ROD and are listed in Table A.8-1. The cleanup goals for all COCs in OU-5 are based on the Safe Drinking Water Act (MCLs) and a review of any changes in this ARAR is presented in Attachment 7. As for the OU-1 COCs, a review of toxicity criteria which have changed since the ROD was signed was performed for OU-5 COCs. Toxicity criteria updates for OU-5 COCs are identified in Table A.8-1 (USEPA 2016b). In Tables A.8-2 and A.8-3, the current toxicity criteria are presented. All of the cleanup goals were developed based on ARARs and not risk-based concentrations, therefore, a compilation of toxicity criteria used to develop cleanup goals is not provided.

Significant Finding

Yes, the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection are still valid. Exposure to hazardous substances at OU-5 is still being prevented by the landfill cap and the restrictions on groundwater use. Updates in toxicity criteria for COCs established in the ROD do not affect the protectiveness of the groundwater cleanup levels. No exposure to ecological receptors is expected.

References

Department of Army 1988. The Army Safety Program, Army Regulation 385-10.

Department of Defense 1993. Military Standard System Safety Program Requirements, MIL-STD-882C.

U. S. Army Corps of Engineers (USACE) 2000. Engineer Pamphlet 1110-1-18 Ordnance and Explosives Response.

USACE 2015. Engineer Manual 200-1-15 Technical Guidance for Military Munitions Response Actions

U.S. Environmental Protection Agency (USEPA) 1990. National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule, FR Vol. 55, No. 46, March 8, 1990, available from U.S. Government Printing Office, Washington, D.C

USEPA 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December.

USEPA 2004, Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, EPA/540/R/99/005, OSWER 9285.7-02EP, Office of Solid Waste and Emergency Response, Washington, DC (including 2007 updates on-line); http://www.epa.gov/oswer/riskassessment/ragse/index.htm

USEPA 2009, Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), EPA-540-R-070-002 (January), http://www.epa.gov/oswer/riskassessment/ragsf/

USEPA 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. http://www.epa.gov/oswer/riskassessment/pdf/superfund-hh-exposure/OSWER-Directive-9200-1-120-ExposureFactors.pdf

USEPA 2015a, Assessment of Mitigation Systems on Vapor Intrusion: Temporal Trends, Attenuation Factors, and Contaminant Migration Routes under Mitigated And Non-mitigated Conditions. EPA/600-R-13-241.

USEPA June 2015b. OSWER Technical Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. OSWER Publication 9200.2-154.

USEPA 2016a, Regional Screening Levels (RSL) Summary Table, May 2016 (table last updated); available via EPA Region web sites, e.g., https://www.epa.gov/risk/regional-screening-levels-rsls

USEPA 2016b, Integrated Risk Information System (IRIS), National Center for Environmental Assessments. http://www.epa.gov/iris/

USEPA 2016, OSWER Vapor Intrusion Assessment VISL Calculator Version 3.5.1, June 2016, http://www.epa.gov/vaporintrusion

USEPA Region X. December 2012. Office of Environmental Assessment Recommendations Regarding TCE Toxicity in Human Health Assessments.

Weston 2012. Vapor Intrusion Pathway Study Report, Tobyhanna Operable Unit 1.

Table A.8-1 Summary of Toxicity Criteria Changes for Tobyhanna Human Health Constituents of Concern

Constituent of Concern	Operable Units	Media	Cleanup Goal Basis	Date of RODs[1]	Toxicity Criteria Last Reviewed in IRIS	Current Toxicity Criteria Source and Date if not IRIS	Change in Toxicity Criteria since ROD?
Tetrachloroethene	1, 5	Groundwater	ARAR	1997, 2000	2012	IRIS	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
Trichloroethene	1, 5	Groundwater	ARAR	1997, 2000	2011	IRIS	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
Vinyl chloride	1, 5	Groundwater	ARAR	1997, 2000	2000	IRIS	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
cis-1,2-Dichloroethene*	1,5	Groundwater	NA*	1997, 2000	2010	IRIS	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
trans-1,2-Dichloroethene*	1,5	Groundwater	NA*	1997, 2000	2002	IRIS	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
Benzene	5	Groundwater	ARAR	2000	2003 (non-cancer), 2000 (cancer)	IRIS	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
1,2,-Dichloropropane	5	Groundwater	ARAR	2000	1991 (inhalation non-cancer only)	IRIS (inhalation reference concentration), CalEPA (cancer assessment, 1999)	No change in toxicity criteria
Pentachlorophenol	5	Groundwater	ARAR	2000	2010	IRIS (oral cancer slope factor and oral reference dose), CalEPA (inhalation unit risk, 2011)	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.
bis(2-Ethylhexyl) phthalate	5	Groundwater	ARAR	2000	1987 (non-cancer), 1988 (cancer)	IRIS (oral cancer slope factor and oral reference dose), CalEPA (inhalation unit risk, 2011)	No change in primary toxicity criteria for ingestion; new Tier III toxicity source (CalEPA) for inhalation.
Arsenic	5	Groundwater	ARAR	2000	1991 (non-cancer), 1995 (cancer)	IRIS (cancer criteria and oral reference dose), CalEPA (inhalation reference dose, 2008)	No change in primary toxicity criteria for ingestion; new Tier III toxicity source (CalEPA) for inhalation.
Barium	5	Groundwater	ARAR	2000	2005 (oral non-cancer), 1998 (inhalation non-cancer and cancer assessments)	IRIS (oral reference dose), HEAST (inhalation reference concentration)	Yes, toxicity criteria have changed for this compound. Please see new toxicity criteria in Tables A.8-2 and A.8-3.

1. Table 6-3 of the 1997 OU-1 ROD provides toxicity constants for human constituents of potential concern. The footnotes to that table indicate that the toxicity criteria were obtained from 1992 databases (EPA's Integrated Risk Information System, IRIS) or tables (Health Effects Assessment Summary Tables, HEAST).

IRIS is the USEPA Integrated Risk Information System, the primary source of toxicity criteria for CERCLA risk assessments.
PPRTV are the USEPA's provisional peer reviewed toxicity criteria, the secondary source of toxicity criteria for CERCLA, when IRIS toxicity criteria are absent.
CalEPA is the California Environmental Protection Agency, a tertiary source of toxicity criteria for CERCLA, when IRIS toxicity criteria are absent.
HEAST is the USEPA's health effects summary assessment table, a tertiary source of toxicity criteria for CERCLA, when IRIS toxicity criteria are absent.
The hierarchy of toxicity sources for CERCLA risk assessments was established in 2003 in the USESPA OSWER directive, 9285.7-53
* Although cis- and trans-1,2-DCE are not Constituents of Concern, they are being monitored in groundwater as degradation products of the other COCs.

Table A.8-2 EPA's Current Recommended Toxicity Criteria for Carcinogens

Chemical	CAS #	Oral Cancer Slope Factors			Inhalation Unit Cancer Risk Factors		
		Current SFo $(mg/kg\text{-}day)^{-1}$	Ref	Date Toxicity Updated or Reviewed	Current URF $(ug/m3)^{-1}$	Ref	Date Toxicity Updated or Reviewed
Barium	7440-39-3	NA		1998	NA		1998
Benzene	71-43-2	5.50E-02	I	2000	7.80E-06	I	2000
Pentachlorophenol	87-86-5	4.00E-01	I	2010	5.10E-06	C	2011
Tetrachloroethene	127-18-4	2.10E-03	I	2012	2.60E-07	I	2012
Trichloroethene	79-01-6	4.60E-02	I	2011	4.10E-06	I	2011
cis-1,2-Dichloroethene	156-59-2	NA		2010	NA		2010
trans-1,2-Dichloroethene	156-60-5	NA		2010	NA		2010
Vinyl chloride- Continuous lifetime exposure during adulthood (worker)	75-01-4	7.20E-01	I	2000	4.40E-06	I	2000

Reference (Ref):
ABSgi and ABSd were obtained from Supplemental Guidance to RAGS: Dermal Risk Assessment (EPA, 2004)
I = Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS)
P = Provisional Peer-Reviewed Toxicity Values (PPRTV)
C = California Environmental Protection Agency
H = Health Effects Assessment Summary Table (HEAST)
S = Regional Screening Level (RSL) table
A = Agency for Toxic Substances and Disease Registry
N = National Center for Environmental Assessment
R6 = Region 6 Medium-Specific Screening Levels (MSSLs)
RSL = Regional Screening Level Table (Oak Ridge National Laboratory, 2008)
NA = No cancer slope or risk factors are available as this compound is not a carcinogen

SFo - Oral Slope Factor
URF - Inhalation Unit Risk Factor

In applying vinyl chloride toxicity data, CLEfB has been applied to children and CLEdA has been applied to adults CLEfB- Continuous Lifetime Exposure from Birth

Table A.8-3 EPA's Current Recommended Toxicity Criteria for Non-Carcinogens

		Oral Reference Dose Values				Inhalation Reference Concentration Values			
		Current RfDo (mg/kg-day)	Date Toxicity Updated	Ref	RfDo Target Organ	RfC Target Organ	Current RfC (mg/m3)	Date Toxicity Updated	Ref
Barium	7440-39-3	2.00E-01	2005	I	kidney	kidney	5.00E-04	1998	H
Benzene	71-43-2	4.00E-03	2003	I	immune	immune	3.00E-02	2003	I
Pentachlorophenol	87-86-5	5.00E-03	2010	I	liver		NA		
Tetrachloroethene	127-18-4	6.00E-03	2012	I	liver	nervous system	4.00E-02	2012	A
Trichloroethene	79-01-6	5.00E-04	2011	I	liver, kidney, fetus	nervous system, eyes	2.00E-03	2011	i
cis-1,2-Dichloroethene	156-59-2	2.00E-03	2010	I	blood		NA	2010	
trans-1,2-Dichloroethene	156-60-5	2.00E-02	2010	I	kidney		NA	2010	
Vinyl chloride	75-01-4	3.00E-03	2000	I	liver	liver	1.00E-01	2000	I

Reference (Ref):
I = Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS)
P = Provisional Peer-Reviewed Toxicity Values (PPRTV)
C = California Environmental Protection Agency
H = Health Effects Assessment Summary Table (HEAST)
S = Regional Screening Level (RSL) table
A = Agency for Toxic Substances and Disease Registry N = National Center for Environmental Assessment

RfC - Inhalation Reference Concentration
RfDo - Oral Reference Dose

Table A.8-4 Comparison of Maximum Detected Concentrations of COCs in Soil with Risk-Based Concentrations Protective of Direct Soil Exposure Pathways

Contaminant	Area A	Area B (following removal action)	USEPA Industrial Soil RSL	USEPA Residential Soil RSL
PCE	0.11	0. 88	100	24
TCE	0.043	0.56	6	0.94

All concentrations are provided in mg/kg
Contaminant concentrations extracted from Table 2-1 of the 1997 OU-1 ROD
USEPA RSLs are the risk-based screening levels from the May 2016 table.

Table A.8-5 Comparison of Vapor Intrusion Risk-Based Screening Levels for OU-1

	PaDEP 2012	PaDEP 2012	ORNL 2012	ORNL 2012	Current 2016 USEPA	Current 2016 USEPA
VIP COCs	Act 2 Residential MSCSGa (µg/m3)	Act 2 Residential MSCIAQa (µg/m3)	Residential Soil Gas RSLb (µg/m3)	Residential Indoor Air RSLc (µg/m3)	Residential Indoor Air RSL, ILCR 1E-06 (µg/m3)	Residential Indoor Air RSL, HQ =1 (µg/m3)
1,2-dichloroethene (1,2-DCE)	4,900d	49d	630e	63e	NA	NA
Tetrachloroethene (PCE)	3,600	36	94	9.4	11	42
Trichloroethene (TCE)	1,200	12	4.3	0.43	0.48	2.1
Vinyl chloride (VC)	240	2.4	1.6	0.16	0.17	100

Table excerpted from Table 2-1 of the 2012 Vapor Intrustion Pathway Study Report, OU-1, November 2012

USEPA RSL are May 2016 values

a All soil gas and indoor air criteria from *PADEP Technical Guidance Manual* (PADEP, 2004)

b Resident Air value from ORNL Regional Screening Level (RSL) Summary Table (April 2012) (values adjusted by an attenuation factor of 0.1) (EPA, 2012)

c Resident Air value from ORNL Regional Screening Level (RSL) Summary Table (April 2012) (EPA, 2012)

d cis-1,2-dichloroethene values have been used

e trans-1,2-dichloroethene values have been used. The value has been adjusted to a Hazard Quotient of 0.1 to account for additive effects (EPA, 2009).

ATTACHMENT 9

Public Notice

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PUBLIC NOTICE

TOBYHANNA ARMY DEPOT, TOBYHANNA, PENNSYLVANIA
U.S. ARMY BEGINS FOURTH FIVE-YEAR REVIEW

The U.S. Army has begun the fourth five-year review of environmental remedies undertaken at Installation Restoration Program and Military Munitions Response Program sites on the Tobyhanna Army Depot, Monroe County, Pennsylvania. The focus of this National Priorities List five-year review will be Operable Unit (OU) 1 (Areas A and B), OU-4, and OU-5.

OU-1 Areas A and B are located in the southeast corner of the depot. Area A was used from the 1950s to the early1960s for waste burning and in-place burial of ash residue. Area B was used in the 1950s for drum staging and disposal during construction of the depot. Soil and groundwater contamination by volatile organic compounds occurred as a result of these activities. Contaminated soil was removed in 1995. A Record of Decision (ROD) was issued by the U.S. Army that established no further action for soils and natural attenuation with long-term monitoring and institutional controls for groundwater. The ROD was signed by U.S. Army and U.S. Environmental Protection Agency (USEPA) in 1997.

OU-4 is an unexploded ordnance (UXO) area in the northern portion of the depot known as Powder Smoke Ridge. The UXO was caused by projectiles fired from artillery ranges used during World War 1 and World War 2. The OU-4 ROD established institutional controls for the site that included physical controls, security controls, monitoring, UXO support, propriety controls, and periodic reviews. The ROD was signed by U.S. Army and USEPA in 2000.

OU-5 is an inactive landfill near the western boundary of the depot. The landfill was operated from 1963 to 1979 and was reported to have received plating wastes and sludge, sewage treatment plant sludge, ash from burning pits, construction rubble, paints, solvents, oils, sanitary wastes, and pesticide containers. Groundwater has been contaminated by volatile organic compounds and metals. The OU-5 ROD established natural attenuation with long-term monitoring and institutional controls. The ROD was signed by U.S. Army and USEPA in 2000.

The five-year review will be conducted to determine whether the remedies remain protective of human health and the environment and function as intended by the RODs. The five-year review will also assess factors to determine if the remedies will continue to be protective in the future. The report is scheduled for completion by September 27, 2017.

If you have any concerns about these sites, please contact:

Mr. Edwin Mickley
Public Affairs Officer
Tobyhanna Army Depot
11 Hap Arnold Blvd.
Tobyhanna, PA 18466-5076
(570) 615-7308
edwin.j.mickley.civ@mail.mil

A copy of the final report will be available at the following location:

Information Repository:	**Contact Information:**
Pocono Mountain Public Library 5540 Memorial Blvd. (Route 611) Coolbaugh Township Municipal Center Tobyhanna, Pennsylvania 18466	(570) 894-8860 Hours: 10 a.m. to 8 p.m. (Monday and Wednesday) 10 a.m. to 5 p.m. (Tuesday, Thursday, Friday, and Saturday)

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Announcements

Legal Notices

LEGAL NOTICE

ALL AMERICAN SELF-STORAGE, 1418 Main St., Peckville, PA will offer for sale the property of Laurie/Brian Krause, Unit #F129. Personal & household items. **Date:** 8/6/16. **Time:** 11:00 AM. **Location:** Above.

LEGAL NOTICE

ALL AMERICAN SELF-STORAGE, 1418 Main St., Peckville, PA will offer for sale the property of Ashley Younes, Unit #D72/D73. Furniture, baby items, boxes, personal belongings. **Date:** 8/6/16. **Time:** 11:00 AM. **Location:** Above.

ADVERTISEMENT FOR BIDS

LACKAWANNA RIVER BASIN SEWER AUTHORITY ARCHBALD WWTP SOLIDS HANDLING IMPROVEMENTS

Contract 16-5.1 GENERAL
Contract 16-5.2 ELECTRICAL
Contract 16-5.3 MECHANICAL HVAC

Owner:
LACKAWANNA RIVER BASIN SEWER AUTHORITY
145 Boulevard Avenue
Throop, PA 18512-3339

Engineer:
GANNETT FLEMING, INC.
Valley Forge Corporate Center
1010 Adams Avenue
Audubon, PA 19403-2402

SEALED Bids will be received by the OWNER at the Lackawanna River Basin Sewer Authority (LRBSA) Attn: Michael Matechek, P.E. Executive Director, until 6:00 p.m., prevailing time, September 12, 2016. The Bids will be publicly opened and read aloud shortly thereafter the same day at the same place.

The Project consists of solids handling improvements at the Archbald WWTP owned and operated by the LRBSA. The solids handling system at the Archbald WWTP includes two 50' diameter aerobic digesters, a dissolved air floatation (DAF) thickener, a belt filter press (BFP) and associated solids handling conveyors, polymer feed equipment, pumps, piping, valving and controls. The existing equipment must remain in operation during construction of the project. LRBSA has already procured a Gravity Belt Thickener (GBT) to replace the DAF thickener and a centrifuge to replace the BFP. The scope of the project includes the following:

Contract 16-5.1 GENERAL

*Replace the fine bubble diffusers in both aerobic digesters with coarse bubble diffusers, supports and associated piping.
*Remove the existing two sludge transfer pumps with three (3) new rotary lobe sludge transfer pumps with associated piping, valving, and controls.
*Remove existing polymer feed equipment from garage and install new polymer feed system in dewatering room including associated piping, valving, controls and modification to existing components.
*Construct addition to existing Digester Building to house the pre-purchased GBT.
*Install pre-purchased centrifuge in garage with associated piping, valving, solids conveyor and controls.
*Modify existing drain system for centrifuge centrate
*Install new dumpster enclosure
*Extend paving and restore disturbed areas

Contract 16-5.2 ELECTRICAL

*Demolish existing Motor Control Center (MCC) and install a new, larger capacity MCC in the Digester Building.
*Install new feed from Control Building to proposed MCC in Digester Building.
*Modify existing power and control as shown on the Drawings to accommodate the new equipment.
*Provide power and control to new equipment associated with General Contract.
*Provide GBT Building with power and lighting.

Contract 16-5.3 MECHANICAL HVAC

*Provide and install mechanical HVAC equipment, ductwork, controls and associated modifications as shown on the Drawings.
*Provide a floor drain in the garage to accommodate centrate from new Centrifuge

The Project Work will be performed under Three (3) Contracts as follows:

CONTRACT 16-5.1 - GENERAL CONSTRUCTION
CONTRACT 16-5.2 - ELECTRICAL WORK
CONTRACT 16-5.3 - MECHANICAL HVAC

Bidding documents may be obtained only from the Issuing Office at Gannett Fleming, Inc., by contacting Mrs. Hollye Wagner at 610-650-8101, internal extension #7263 or by mail at the following mailing address: Gannett Fleming, Inc., P.O. Box 80794, Valley Forge, Pennsylvania 19484-0794. Engineers Project Number 59721.

Bidders purchasing Bidding Documents will receive a CD containing the documents from all Contracts. The documents on the CD require Adobe® Reader®.

Bid document CD cost is $20.00, and is non-refundable. Make checks payable to Gannett Fleming, Inc., Environmental Resources Division.

Each Bid shall be accompanied by a certified check, bank money order, or a Bid Bond in an amount not less than 10 percent of the Bid total, payable to the Owner in accordance with the Instructions to Bidders.

Direct all questions pertaining to securing Bidding Documents, the Bidder's list, and similar documents to Mrs. Hollye Wagner at 610-650-8101, internal extension #7263, and direct all questions pertaining to technical Specifications, legal documents, and submitting Bids to Mr. Anthony Elberti, P.E. internal extension #7127, at Gannett Fleming, Inc., Telephone: 610-650-8101.

Laws and regulations applicable to this Contract include the following:

Legal Notices

Commonwealth of Pennsylvania "Steel Products Procurement Act" - Act No. 3 of 1978 as amended

Pennsylvania Prevailing Wage Act (Act of 1961, P.L. 987, No. 442)

Energy Policy and Conservation Act (P.L. 94-163)

Executive Order 11246, entitled "Equal Employment Opportunity," as amended by Executive Order 11375, and as supplemented in Department of Labor regulations (41 CFR Part 60)

Restrictions on Lobbying (Section 319, Public Law 101-121 (31 U.S.C. 1352))

Bidders are subject to all applicable provisions of the Pennsylvania wage laws, and bids shall be prepared accordingly. The applicable wage predetermination is included in the Project Manual.

The successful bidder will be required to provide a performance bond in the amount of 100% of the successful bid amount.

All contractors on this Project are required to ensure that employees and applicants will not be discriminated against because of race, creed, color, religion, sex, age, handicap, marital status or national origins; and, that the statutes and regulations of federal and state law regarding non-discrimination are met.

Contractors and subcontractors are required to furnish records to ascertain compliance with the Nondiscrimination Clause.

Pennsylvania Infrastructure Investment Authority (PENNVEST) funding has been requested for a portion of this Project. There are no Federal components to the funding. Contractors will be required to comply with all requirements of the funding agency.

A non-mandatory pre-bid meeting will be held at August 24th, 2016 11:00 a.m., prevailing time, at the Archbald Wastewater Treatment Plant in Jermyn, PA listed in this Advertisement for Bids.

The Owner reserves the right, at its option, to waive as an informality any, defects, errors, or omissions in any or all Bids; and to reject any or all Bids.

LACKAWANNA RIVER BASIN
SEWER AUTHORITY
Michael Matechak, P.E.
Executive Director

LEGAL NOTICE

Fell Township will receive sealed proposals for bituminous pavement in-place on Buffalo Road (T630), 825 feet long by 19 feet wide. Section starts at a point 825 feet north of State Route 171.
Bids will be received by the Township of Fell of Lackawanna County, PA, 1 Veterans Drive, Simpson, PA 18407 by mail or hand delivered by appointment until 6:00 pm Friday 19 August 2016. The proposals will be opened and read aloud at said time at the Township Building, 1 Veteran Drive, Simpson, PA. The date contract will be awarded or canceled will be announced at bid opening. The Township reserves the right to accept or reject this bid without reason.

Work must be completed within 30 days of award.

Specifications and forms available by mail to the above address or phone 570-282-0319. A ten dollar fee is required for each bid package.

ANN MARIE TORCH
SECRETARY/SUPERVISOR

LEGAL NOTICE

PENNSYLVANIA PUBLIC UTILITY COMMISSION NOTICE

Application of Supreme Energy, Inc. For Approval To Offer, Render, Furnish Natural Gas Services as a Supplier Engaged In The Business of Supplying Natural Gas Supply Services To The Public In The Commonwealth Of Pennsylvania.
Supreme Energy, Inc. has filed an application with the Pennsylvania Public Utility Commission ("PUC") for a license to provide natural gas supply services as (1) a supplier of natural gas. Supreme Energy, Inc. proposes to sell natural gas and related services in the service territories of the following utility companies: Columbia Gas, Peoples Equitable Gas, National Fuel Gas, PECO, Peoples Natural Gas, Peoples TWP LLC, Philadelphia Gas Works, UGI Utilities, UGI Central Penn, and UGI Penn Natural under the provisions of the new Natural Gas Choice and Competition Act.
The PUC may consider this application without a hearing. Protests directed to the technical or financial fitness of Supreme Energy, Inc. may be filed within 15 days of the date of this notice with the Secretary of the PUC, P.O. Box 3265, Harrisburg, PA 17105-3265. You should send copies of any protest to Supreme Energy, Inc.'s attorney at the address listed below.

By and through Counsel:
Deborah Berna Fineman
Supreme Energy, Inc.
532 Freeman Street
Orange, NJ 07050
(973) 678-1800
(973) 672-0148 - Fax

MEETING NOTICE

Moosic Borough Committee members of the Department of Works will hold a meeting on Friday, August 5, 2016 @6:30p.m. at the Moosic Borough Building, 715 Main Street, Moosic, PA 18507. The public is invited.

LEGAL NOTICE

PENNSYLVANIA PUBLIC UTILITY COMMISSION NOTICE

*Application of **PARK POWER, LLC dba PARK POWER** For Approval To Offer, Render, or Furnish Services as a **Supplier** Engaged In The Business Of Supplying Natural Gas Supply Services To The Public In The Commonwealth Of Pennsylvania.*

PARK POWER, LLC dba PARK POWER will be filing an application with the Pennsylvania Public Utility Commission ("PUC") for an expanded license to provide natural gas supply services as a supplier of natural gas engaged in the business of providing natural gas services. **PARK POWER, LLC dba PARK POWER** proposes to sell natural gas and related services in the service territories of Columbia Gas of Pennsylvania, the Peoples Natural Gas Company, Peoples Natural Gas Company Equitable Division, Peoples TWP, LLC, UGI Utilities, UGI Central Penn Gas, UGI Penn Natural Gas,

Legal Notices

Philadelphia Gas Works, and Valley Energy under the provisions of the new Natural Gas Choice and Competition Act.

The PUC may consider this application without a hearing. Protests directed to the technical or financial fitness of **PARK POWER, LLC dba PARK POWER** may be filed within 15 days of the date of this notice with the Secretary of the PUC, P.O. Box 3265, Harrisburg, PA 17105-3265. You should send copies of any protest to **PARK POWER, LLC's** attorney at the address listed below:

By and through Counsel:
Michael Gruin, Esq.
Stevens & Lee
17 N. 2nd St., 16th Fl.
Harrisburg, PA 17101
Phone (717) 255-7365
Fax (610) 988-0852

PUBLIC NOTICE

TOBYHANNA ARMY DEPOT, TOBYHANNA, PENNSYLVANIA U.S. ARMY BEGINS FOURTH FIVE-YEAR REVIEW

The U.S. Army has begun the fourth five-year review of environmental remedies undertaken at Installation Restoration Program and Military Munitions Response Program sites on the Tobyhanna Army Depot, Monroe County, Pennsylvania. The focus of this National Priorities List five-year review will be Operable Unit (OU) 1 (Areas A and B), OU-4, and OU-5.

OU-1 Areas A and B are located in the southeast corner of the depot. Area A was used from the 1950s to the early 1960s for waste burning and in-place burial of ash residue. Area B was used in the 1950s for drum staging and disposal during construction of the depot. Soil and groundwater contamination by volatile organic compounds occurred as a result of these activities. Contaminated soil was removed in 1995. A Record of Decision (ROD) was issued by the U.S. Army that established no further action for soils and natural attenuation with long-term monitoring and institutional controls for groundwater. The ROD was signed by U.S. Army and U.S. Environmental Protection Agency (USEPA) in 1997.

OU-4 is an unexploded ordnance (UXO) area in the northern portion of the depot known as Powder Smoke Ridge. The UXO was caused by projectiles fired from artillery ranges used during World War 1 and World War 2. The OU-4 ROD established institutional controls for the site that included physical controls, security controls, monitoring, UXO support, propriety controls, and periodic reviews. The ROD was signed by U.S. Army and USEPA in 2000.

OU-5 is an inactive landfill near the western boundary of the depot. The landfill was operated from 1963 to 1979 and was reported to have received plating wastes and sludge, sewage treatment plant sludge, ash from burning pits, construction rubble, paints, solvents, oils, sanitary wastes, and pesticide containers. Groundwater has been contaminated by volatile organic compounds and metals. The OU-5 ROD established natural attenuation with long-term monitoring and institutional controls. The ROD was signed by U.S. Army and USEPA in 2000.

The five-year review will be conducted to determine whether the remedies remain protective of human health and the environment and function as intended by the RODs. The five-year review will also assess factors to determine if the remedies will continue to be protective in the future. The report is scheduled for completion by September 27, 2017.

If you have any concerns about these sites, please contact:

Mr. Edwin Mickley
Public Affairs Officer
Tobyhanna Army Depot
11 Hap Arnold Blvd.
Tobyhanna, PA 18466-5076
(570) 615-7308
edwin.j.mickley.civ@mail.mil

A copy of the final report will be available at the following location:

Information Repository:
Pocono Mountain Public Library
5540 Memorial Blvd. (Route 611)
Coolbaugh Township Municipal Center
Tobyhanna, Pennsylvania 18466

Contact Information:
(570) 894-8860
Hours: 10 a.m. to 8 p.m. (Monday and Wednesday)
10 a.m. to 5 p.m. (Tuesday, Thursday, Friday, and Saturday)

Classifieds Work!

LEGAL NOTICE

THE BOARD OF ZONING APPEALS OF THE CITY OF SCRANTON HEREBY GIVES NOTICE THAT IT WILL HOLD A MEETING AT CITY HALL, IN COUNCIL CHAMBERS, ON **WEDNESDAY, AUGUST 10, 2016 at 6pm.**

1) **John Zhang, c/o Just Property Management LLC, 611 Monroe Ave.** Applicant seeks a variance in order to allow six (6) units at this location. R1-A Zone.

2) **Alfred Sebastianelli, 1017 Main St., Peckville, PA.** Applicant seeks an Special Exception to operate the property located at 701-711 Race St. as a retail storefront with Storage and warehousing. Additionally, an upper-level loft apartment is requested above the retail store area. R1-A Zone.

3) **George and Judith Reihner, 1010 Electric St.** Applicant seeks to appeal the decision of the Zoning Office to deny the use and operation of a Bed and Breakfast within a R1-A district. R1-A Zone.

4) **T & G Inc, d/b/a Hosko's Scrap Yard, 417 N. Keyser Ave.** Applicant seeks to appeal the Zoning Officer's May 13, 2016 decision to deny T & G Inc.'s October 15, 2015 and January 13, 2016 letter request seeking the issuance of a notice of violation to Edward G. Zymblosky, Jr., Gail Zymblosky, Edward G. Zymblosky, III and Ben Weitsman & Son of Scranton, LLC, and a cease & desist order to Ben Weitsman & Son of Scranton, LLC. I-L Zone.

ANYONE INTERESTED IN BECOMING A PARTY TO THE ABOVE LISTED CASES IS DIRECTED TO CONTACT THE CITY ZONING OFFICER @ 570-348-4193, Ext. 4512.

Shawn Walsh, Chairman
Scranton Zoning Board

Estate Notices

ESTATE NOTICE

IN RE: Estate of Deborah Theresa Blanchard, late of Dickson City, Pennsylvania, died May 14, 2016. Notice is hereby given that Letters of Administration, on the above estate have been granted to Christine E. Popeck, Administrator. All persons indebted to the said Estate are required to make payment and those having claims to present the same without delay to the Administrator named above or to Theresa J. Malski-Pezak, Esquire, 907 Church Street, Jessup, Pennsylvania 18434, Attorney for the Estate.

ESTATE NOTICE

ESTATE of **Edward A. Samsell**, deceased, late of Dunmore, Lackawanna County, Pennsylvania. Notice is hereby given that Letters of Administration have been granted in the above Estate. All persons indebted to said Estate are required to make payment and those having claims or demands are to present the same without delay to: Robin D. Samsell, 50 Darling St., Wilkes Barre PA 18702 or Joseph D. Silvaggio, Esquire, Willman & Silvaggio, LLP, 5500 Corporate Dr., Suite 150, Pittsburgh, PA 15237.

ESTATE NOTICE

RE: Estate of Joseph Woytovich, late of Old Forge, Lackawanna County, Pennsylvania (died July 12, 2016). Notice is hereby given that Letters of Administration for the Estate of Joseph Woytovich have been issued to John Woytovich, Jr., Administrator of the Estate. All those having claims or demands against the Estate or indebtedness owed to the Estate shall present claims or remit payment without delay to the Administrator at 718 N. Russell St., Mount Prospect, IL 60056 or to Kris E. Fendrock, Esquire, Myers, Brier & Kelly, LLP, Attorney for the Estate, 425 Spruce Street, Suite 200, Scranton, PA 18503.

ESTATE NOTICE

IN RE: Estate of LEO DAVID, DECEASED, late of 815 ALBERT STREET, DICKSON CITY, PA 18519, (Died MAY 14, 2016). Notice is hereby given that Letters of Administration on the above estate have been granted to GERALD EDWARD DAVID, Administrator.

All persons indebted to the said estate are required to make payment and those having claims to present the same without delay to the Administrator named above or to Mark G. Rudalavage, 171 Scranton-Carbondale Highway, Eynon, Pennsylvania 18403.

MARK G. RUDALAVAGE, ESQUIRE

Estate Notices

ESTATE NOTICE

Estate of Mary Anne F. Walker, deceased, late of Lackawanna County, Pennsylvania, Letters of Administration have been granted to the undersigned, who requests all persons having claims or demands against the Estate of the Decedent to make known the same, and all persons indebted to the Decedent to make payments without delay to:
Richard E. Walker or his attorney:

James J. Conaboy, Esquire
1006 Pittston Avenue
Scranton, PA 18505

ESTATE NOTICE

RE: ESTATE OF **NICHOLAS J. LEFCOSKI**, late of Moosic, PA, who died June 29, 2016. Letters Testamentary in the above estate having been granted, all persons having claims or demands against the estate of the decedent shall make them known and present them, and all persons indebted to said decedent shall make payment thereof without delay to: Diane Honney, Executrix, or Daniel L. Penetar, Jr., Esquire, 116 North Washington Avenue, Suite 2A, Scranton, PA 18503.

ESTATE NOTICE

Notice is hereby given that Letters Testamentary have been granted in the Estate of William R. Decker, late of Peckville, Lackawanna County, Commonwealth of Pennsylvania, (died: May 7, 2016). All persons indebted to the Estate are requested to make payment and those having claims or demands are to present same, without delay to the Executors: Robert E. Decker and Rhea D. Wilcha or Attorney Albert E. Nicholls, Jr., 1421 E. Drinker Street, Dunmore, Pennsylvania 18512.

ATTORNEY ALBERT E. NICHOLLS, JR.

Attorneys

$219 Divorce TOTAL
No-Fault Uncontested
Davis Divorce Law
No travel. Free Info
1-800-486-4070 24/7

AFFORDABLE FEES
Divorce DUI **ADOPTION**
BANKRUPTCY debt relief, agency helping people file bankruptcy
Atty. Marjorie Barlow
344-6543/Scranton

ATTORNEY COLLEEN METROKA
BANKRUPTCY
Payment Plan! Free Consultation
www.cmetrokalaw.com
570-592-4796

Attorneys

BANKRUPTCY
FREE OFFICE VISIT
570-963-7878 Atty. Ray Ferrario
I am a Debt Relief Agency Helping People & Businesses File for Bankruptcy Relief.

NEED HELP?
DUI, Traffic Citation, ARD, Underage Drinking, Drugs, PFA/Domestic Violence. Appeal, Expungement.
FREE INITIAL CONSULTATION!
Jonathan L. Pietrowski
ATTORNEY AT LAW
Former Assistant D.A./Prosecutor
116 N. Washington Ave., Suite 2J Scranton
570-406-0602. jonathan@pietrowski-law.com
www.pietrowski-law.com

Prayers

NOVENA TO THE SACRED HEART- Dear Heart of Jesus. In the past I have asked for many favors. This time I ask You this special one. (Mention favor). Take it Dear Heart of Jesus and place it within Your Heart where your Father sees it. Then in His merciful eyes it will become Your favor and not mine. Amen. Say three times for three days then publish and your favor will be granted. Grateful thanks for granting miracles. Thank you **C.W.S.**

Looking For A New Car? Check Out: The Scranton Times-Tribune Call 570-348-9157 to place a classified ad

Announcements

BACK TO SCHOOL EVENT
Join us to get a free pencil case with school supplies and a chance to win a gift card to Target. We will have fun events at the giveaway. The Gardens of Green Ridge, Mid Valley Manor, and Scranton Manor on August 13th. Old Forge Manor, Kingston Manor, and Wyoming Manor on August 20th. Please call 570-209-0187 to RSVP by August 5th.

BLUEBERRIES
Plentiful & Sweet
You PICK
Mon. & Tues. 8-5, Wed - Sun. 8-7. Closed for rain. Take Rt. 81, Exit 223, follow signs to HILLTOP BERRY FARM, New Milford, PA.
570-465-3515

Turn Your Clutter **Into Cash**
by placing your Merchandise in our

Tuesday Classified Marketplace

THE BEST PLACE TO BUY AND SELL MERCHANDISE IN NORTHEAST PA!

Place Your FREE AD Every Tuesday in the The Times-Tribune

Submit your FREE AD online today at: **tuesdayFREEad.com**

Private party ads. YOUR ad is GUARANTEED to run!

FREE AD QUALIFICATIONS:

- Private party merchandise ads only
- Up to 175 characters per ad (about 30 words).
- No more than 5 items per ad.
- Must include price of each item.
- Total value of all items for sale must be $2,000 or less.
- Pet ads are accepted only if pet is FREE.
- We reserve the right to edit or reject copy.
- One ad per household per week.
- SUBSCRIBER BONUS: Subscribers can place 2 FREE ads each week!
- Deadline: Submit your FREE ad by Friday at 5:00 p.m. for the following Tuesday's edition.
- BONUS: You can also choose to run the ad 6 additional days for just $6!

Email your FREE ad with all the information below by 5:00 p.m. Friday to:
tuesdayFREEad@timesshamrock.com

If you prefer, you may fill out this form and mail to:
The Times-Tribune *149 Penn Avenue, Scranton, PA 18503*
Deadline: Submit your FREE ad by Friday at 5:00 p.m. for the following Tuesday's edition.
Subscriber: yes __ no __
SUBSCRIBER BONUS: 2 FREE ads each week!

Name: _____
Address: _____
City: _____
State/Zip: _____
Phone: _____
Email: _____
Ad copy: Up to 175 characters (about 30 words with phone #)
_____
_____
_____
_____
__ YES! Please extend my FREE ad for 6 days for $6!
Payment info (circle one) VISA MC AMEX DISC
Card Number: _____ Exp: _____
CID: _____
Or make checks payable to: **The Times-Tribune**

Be sure to pick up a copy of the The Times-Tribune every TUESDAY
and check out Northeast PA's BEST place to buy and sell merchandise …
SUBSCRIBE TODAY! CALL 570-348-9157

The Scranton Times (Under act P.L. 877 No 160. July 9,1976)

Commonwealth of Pennsylvania, County of Lackawanna

US ARMY CORPS OF ENGINEERS
ATTN: LINDA LEE
BUFFALO DISTRICT 1776 NIAGARA ST
BUFFALO NY 14207-3199

Account # 618655
Order # 81969300
Ad Price: 487.75

PUBLIC NOTICE TOBYHANNA
Gina Krushinski
Being duly sworn according to law deposes and says that (s)he is Billing clerk for The Scranton Times, owner and publisher of The Scranton Times, a newspaper of general circulation, established in 1870, published in the city of Scranton, county and state aforesaid, and that the printed notice or publication hereto attached is exactly as printed in the regular editions of the said newspaper on the following dates:

08/03/2016

Affiant further deposes and says that neither the affiant nor The Scranton Times is interested in the subject matter of the aforesaid notice or advertisement and that all allegations in the foregoing statement as time, place and character or publication are true Gina Krushinski.

Sworn and subscribed to before me
this 3rd day of August A.D., 2016

Sharon Venturi

(Notary Public)

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Sharon Venturi, Notary Public
City of Scranton, Lackawanna County
My Commission Expires Feb. 12, 2018
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

PUBLIC NOTICE

TOBYHANNA ARMY DEPOT, TOBYHANNA, PENNSYLVANIA U.S. ARMY BEGINS FOURTH FIVE-YEAR REVIEW

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OU-1 Areas A and B are located in the southeast corner of the depot. Area A was used from the 1950s to the early 1960s for waste burning and in-place burial of ash residue. Area B was used in the 1950s for drum staging and disposal during construction of the depot. Soil and groundwater contamination by volatile organic compounds occurred as a result of these activities. Contaminated soil was removed in 1995. A Record of Decision (ROD) was issued by the U.S. Army that established no further action for soils and natural attenuation with long-term monitoring and institutional controls for groundwater. The ROD was signed by U.S. Army and U.S. Environmental Protection Agency (USEPA) in 1997.

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If you have any concerns about these sites, please contact:

Mr. Edwin Mickley
Public Affairs Officer
Tobyhanna Army Depot
11 Hap Arnold Blvd.
Tobyhanna, PA 18466-5076
(570) 615-7308
edwin.j.mickley.civ@mail.mil

A copy of the final report will be available at the following location:

Information Repository:
Pocono Mountain Public Library
5540 Memorial Blvd. (Route 611)
Coolbaugh Township Municipal Center
Tobyhanna, Pennsylvania 18466

Contact Information:
(570) 894-8860
Hours: 10 a.m. to 8 p.m. (Monday and Wednesday)
10 a.m. to 5 p.m. (Tuesday, Thursday, Friday, and Saturday)

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ATTACHMENT 10

Groundwater Data

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OU-1

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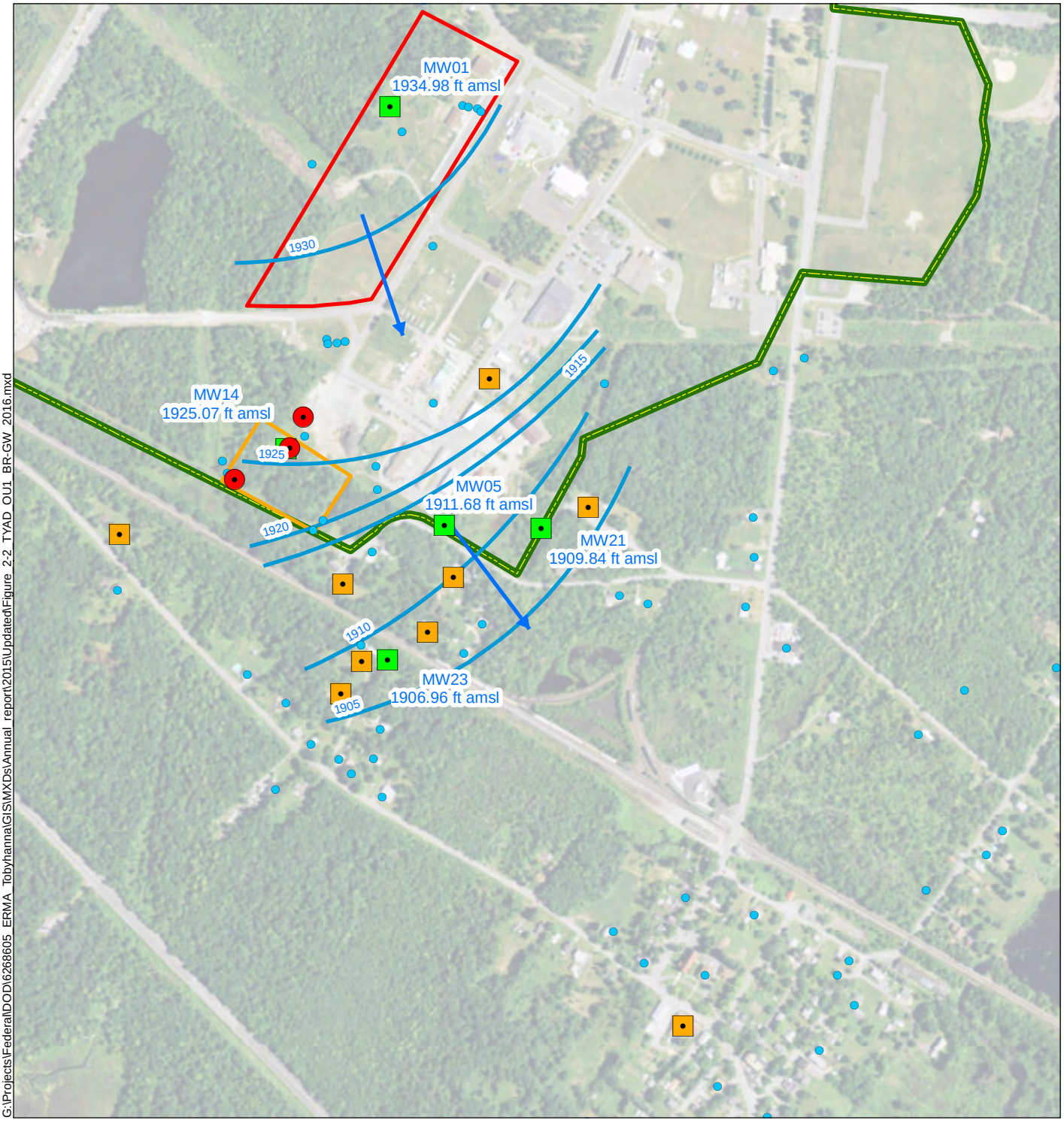
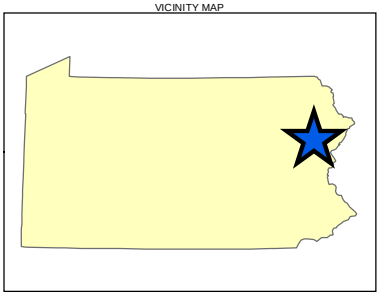


G:\Projects\FederalDOD\6268605_ERMA_Tobyhanna\GIS\MXDs\Annual report\2015\Updated\Figure_2-2_TYAD_OU1_BR-GW_2016.mxd

VICINITY MAP



0 125 250 500
Feet

1 inch = 600 feet

N

Legend

- Installation Boundary
- OU1 (Area A)
- OU1 (Area B)
- OU1, Bedrock, Monitoring Well
- OU1, Glacial, Monitoring Well
- OU1, Bedrock, Residential Well
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Well, Not Sampled

Figure 2-2
TBAD-004,-007 (OU-1)
Groundwater Elevations
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC

Table 2-3 OU-1 Groundwater Sampling Results for Volatile Organic Compounds of Concern October 2015

Well ID	Aquifer	*cis*-1,2-DCE (µg/L)	*trans*- 1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	PCE (µg/L)	TCE (µg/L)
MCL		70	100	2	5	5
MW01	BR	3.60	0.22 J	1.20 J	0.50 U	3.80
MW05	BR	0.25 U	0.25 U	0.25 U	0.33 J	1.10
MW11	GT	1.80	0.25 U	0.25 U	**14.00**	4.30
MW12	GT	0.25 U	0.25 U	0.25 U	1.10	0.50 U
MW13	GT	1.30	0.25 U	0.25 U	1.50	1.80
MW14	BR	0.99 J	0.25 U	0.25 U	1.10	1.80
MW21	BR	0.25 U	0.25 U	0.25 U	0.79 J	2.30
MW23	BR	0.20 J	0.25 U	0.25 U	1.10	3.10
R1-82	BR	NS				
R1-94	BR	NS				
R1-102	BR	2.60	0.25 U	0.25 U	0.50 U	0.50 U
R1-103	BR	0.38 J	0.25 U	0.25 U	1.20	0.50 U
R1-105	BR	NS				
R1-109	BR	0.25 U	0.25 U	0.25 U	0.50 U	0.50 U
R1-110	BR	0.25 U	0.25 U	0.25 U	2.70	3.10
R1-110-2	BR	0.25 U	0.25 U	0.25 U	0.50 U	0.50 U
R1-111	BR	0.25 U	0.25 U	0.25 U	1.80	1.70
R1-116	BR	0.25 U	0.25 U	0.25 U	0.50 U	0.50 U
R2-15	BR	NS				
R2-23	BR	0.25 U	0.25 U	0.25 U	0.50 U	0.48 J
ON3	BR	NS				

Notes:
µg/L = Micrograms per liter
J = Indicates sample results between the Method Detection Limit and Contract Required Detection Limit
MCL = (Safe Drinking Water Act) Maximum Contaminant Level
NS = Not sampled
U = Less than the detection limit provided
PCE = Tetrachloroethene
TCE = Trichloroethene
Highlight/bold equivalent to or exceeds MCL.

Table 2-4 Historical OU-1 Monitor/Residential Well Sampling Program Groundwater Sampling Results for TCE

Well ID	Aquifer	Oct-01 (µg/L)	Apr-02 (µg/L)	Oct-02 (µg/L)	Apr-03 (µg/L)	Oct-03 (µg/L)	Apr-04 (µg/L)	Oct-04 (µg/L)	Apr-05 (µg/L)	Oct-05 (µg/L)	Apr-06 (µg/L)	Oct-06 (µg/L)	Apr-07 (µg/L)	Dec-08 (µg/L)	Nov-09 (µg/L)	Nov-10 (µg/L)	Nov-11 (µg/L)	Oct-12 (µg/L)	Oct-13 (µg/L)	Jul-15 (µg/L)	Oct-15 (µg/L)
MCL		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
MW01	BR	**30.00**	**11.00**	**6.70**	**5.30**	4.70	**14.00**	**6.40**	**7.00**	**6.00**	**7.00**	**7.00 J**	4.00	**5.57**	**8.70**	4.50	3.50	3.30	3.20	3.40	3.80
MW02	GT	0.16 J	1.00 U	0.10 J	1.40	0.43	1.00 U	1.40	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW03	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW05	BR	2.50	3.70	2.40	2.10	3.00	5.00	3.80	4.00 J	4.00 J	4.00 L	3.00	2.00	2.58	3.10	3.10	2.20	2.10	2.10	1.00	1.10
MW07	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW08	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW11	GT	**8.50**	**8.10**	**8.10**	**8.10**	**6.10**	**8.10**	**7.80**	**7.00**	**7.00**	**6.00**	**7.00**	**5.00**	**5.78**	**5.80**	**7.10**	4.50	4.20	4.00	4.50	4.30
MW12	GT	NS	NS	0.28 J	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	0.20 J	0.60 B	0.80 J	1.00 U	0.53 J	1.00 U	1.00 U	1.00 U	1.00 U	0.15 J	0.50 U	0.50 U
MW13	GT	**8.10**	**5.80**	**11.00**	0.89 J	1.00	1.30	2.70	3.00 J	**5.00**	0.80 J	**6.00**	1.00	**6.59**	**7.90**	**8.90**	4.00	**5.70**	2.90	1.70	1.80
MW14	BR	2.40	2.00	1.60	2.70	3.00	3.40	3.20	3.00 J	**8.00 J**	2.00 J	4.00	2.00	**5.33**	2.90	3.10	1.70	1.70	1.70	2.20	1.80
MW17	BR	NS	**5.30**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW18	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW19	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW21	BR	4.10	NS	3.70	3.80	3.80	**7.10**	4.30	4.00 J	4.00 J	**5.00**	**7.00**	2.00	3.21	**9.70**	**10.00**	2.40	2.20	2.90	1.20	2.30
MW22	BR	0.80 J	1.90	1.50	1.60	2.60	1.10	2.60	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW23	BR	4.30	4.60	3.50	**11.00**	**13.00**	**22.00**	4.50	**19.00**	**16.00**	**16.00**	**21.00**	**8.00**	**15.00**	**15.00**	**15.00**	**11.00**	**10.00**	**9.80**	4.70	3.10
R1-82	BR	1.30	1.50	1.30	0.92 J	1.20	1.30	1.00 U	1.00 J	NS	1.00	NS	0.70 J	1.33	1.30	NS	0.79 J	0.91 J	0.99 J	NS	NS
R1-94	BR	0.43 J	0.50 J	0.43 J	0.26 J	0.21 J	1.00 U	1.00 U	5.00 U	NS	0.20 J	NS	1.00 U	0.40 J	NS	NS	NS	NS	NS	NS	NS
R1-102	BR	2.70	2.20	1.70	0.52 J	0.83 J	**10.00**	1.00 U	NS	**9.00**	NS	**9.00**	0.70 J	**7.07**	**8.00**	**7.80**	**5.10**	**5.30**	**5.00**	0.56 J	0.50 U
R1-103	BR	**6.10**	3.40	**7.40**	2.30	**6.60**	**8.70**	2.00	NS	**9.00**	NS	**6.00**	3.00	2.15	**6.20**	4.40	0.59 J	0.41 J	0.25 J	0.50 U	0.50 U
R1-105	BR	**5.00**	**6.40**	**5.20**	**5.10**	4.90	NS	4.80	NS	**5.00**	NS	**9.00**	3.00	NS	1.60	**6.30**	**5.40**	**5.30**	2.50	NS	NS
R1-109	BR	3.00	2.40	3.60	2.40	**5.60**	**5.10**	1.00 U	NS	3.00	NS	1.00	2.00	2.53	3.80	**5.20**	0.92 J	2.10	4.30	0.50 U	0.50 U
R1-110	BR	4.60	4.70	**5.00**	4.10	**5.20**	**5.90**	**5.30**	NS	**5.00**	NS	**5.00**	3.00	3.87	4.30	4.10	3.30	3.00	3.20	0.50 U	3.10
R1-110-2	BR	0.07 J	0.64 J	0.11 J	1.00 U	1.00 U	**6.10**	2.50	NS	**5.00**	NS	**5.00**	3.00	2.56	4.20	4.20	2.90	2.70	2.60	0.50 U	0.50
R1-111	BR	2.50	2.20	2.10	2.00	2.30	2.90	1.00 U	3.00 J	3.00	2.00	3.00	2.00	NS	1.00 U	2.20	1.60	1.40	1.60	0.50 U	1.70
R1-116	BR	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 B	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.50 U	0.50 U
R2-15	BR	1.30	0.72 J	1.10	1.00	3.30	1.40	1.40	1.00 J	2.00	1.00 J	1.00	0.50 J	1.13	1.00 U	1.20	0.77 J	0.80 J	0.87 J	NS	NS
R2-23	BR	0.86 J	0.90 J	0.80 J	0.65 J	0.59 J	1.00	1.30	1.00 J	NS	0.50 B	NS	0.30 J	0.88 J	0.70 J	NS	0.45 J	0.53 J	0.41 J	0.39 J	0.48 J
ON3	BR	4.00	3.60	3.60	2.90	3.10	2.90	3.00	NS	4.00	NS	3.00 J	2.00	3.41	3.70	3.40	1.90	1.90	2.50	2.20 J	NS

Notes:
µ/L = Micrograms per liter
B = Detected in blank sample
BR = Bedrock aquifer
GT = Glacial till aquifer
J = Indicates sample results between the Method Detection Limit and Contract Required Detection Limit
L = Results biased low
MCL= (Safe Drinking Water Act) Maximum contaminant level
NS = Not sampled
U = Less than the detection limit provided
TCE = Trichloroethene
Highlight/bold is equivalent to or exceeds MCL.

Table 2-5 Historical OU-1 Monitor/Residential Well Sampling Program Groundwater Sampling Results for PCE

Well ID	Aquifer	Oct-01 (µg/L)	Apr-02 (µg/L)	Oct-02 (µg/L)	Apr-03 (µg/L)	Oct-03 (µg/L)	Apr-04 (µg/L)	Oct-04 (µg/L)	Apr-05 (µg/L)	Oct-05 (µg/L)	Apr-06 (µg/L)	Oct-06 (µg/L)	Apr-07 (µg/L)	Dec-08 (µg/L)	Nov-09 (µg/L)	Nov-10 (µg/L)	Nov-11 (µg/L)	Oct-12 (µg/L)	Oct-13 (µg/L)	Jul-15 (µg/L)	Oct-15 (µg/L)
MCL		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
MW01	BR	0.33 J	0.37 J	0.14 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.70 J	0.30 J	0.10 J	0.20 J	0.20 J	1.00 U	0.19 J	0.17 J	1.00 U	0.15 J	0.50 U	0.50 U
MW02	GT	0.30 J	0.30 J	0.35 J	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW03	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW05	BR	0.67 J	1.40	0.73 J	0.63 J	1.10	2.60	2.00	2.00 J	**5.00**	1.00 L	1.00	0.70 J	0.92 J	1.30	1.10	0.71 J	0.81 J	0.74 J	0.33 J	0.33 J
MW07	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW08	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW11	GT	**26.00**	**30.00**	**35.00**	**24.00**	**16.00**	**17.00**	**24.00**	**22.00**	**16.00**	**13.00**	**13.00**	**8.00**	**11.30**	**17.00**	**20.00**	**14.00**	**17.00**	**8.40**	**13.00**	**14.00**
MW12	GT	NS	NS	1.00 J	1.70	0.76	1.00 U	1.80	5.00 U	3.00	2.00 L	2.00	2.00	2.28	1.80	2.20	2.30	0.78 J	0.67 J	2.10	1.10
MW13	GT	4.40	3.60	4.90	0.86	0.96 J	1.50	2.20	1.00 J	2.00	0.60 J	3.00	0.90 J	3.73	2.70	**5.80**	2.90	4.20	2.20	1.80	1.50
MW14	BR	1.10 J	0.99 J	0.78 J	1.50	1.50	2.20	2.00	2.00 J	4.00	1.00 J	2.00	1.00	2.56	2.00	2.30	1.30	1.20	1.10	1.50	1.10
MW17	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW18	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW19	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW21	BR	0.98 J	1.40	0.99 J	1.00	1.10	2.30	1.60	1.00 J	2.00	1.00	2.00	0.80 J	0.85 J	3.00	2.70	0.66 J	0.75 J	0.89 J	0.37 J	0.79 J
MW22	BR	1.00 U	0.18 J	0.14 J	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW23	BR	0.99 J	1.10	0.88 J	3.10	3.40	**7.60**	1.60	5.00 U	**5.00**	**5.00**	**5.00**	3.003.00	4.434.43	**5.20**	4.30	3.60	3.60	3.20	1.60	1.10
R1-82	BR	0.34 J	0.36	0.37 J	0.23 J	0.32 J	1.00 U	1.00 U	5.00 U	NS	0.30 J	NS	0.20 J	0.30 J	0.46 J	NS	0.31 J	0.37 J	0.34 J	NS	NS
R1-94	BR	1.00 U	0.10 J	0.13 J	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS
R1-102	BR	1.00	1.00	0.92 J	053. J	0.60 J	4.40	0.56 J	NS	4.00	NS	3.00	1.00 U	2.64	2.90	2.90	1.70	2.20	1.90	0.50 U	0.50 U
R1-103	BR	1.80	1.60	2.30	1.60	2.00	3.00	2.60	NS	4.00	NS	3.00	2.00	1.79	2.80	2.20	1.10	1.00	1.00	0.44 J	1.20
R1-105	BR	1.60	2.40	2.00	2.10	1.60	NS	2.20	NS	2.00	NS	4.00	1.00	NS	1.60	3.10	2.40	2.70	2.30	NS	NS
R1-109	BR	1.30	1.50	1.50	0.84 J	0.57 J	1.90	1.00 U	NS	1.00	NS	0.30 J	0.70 J	0.30 J	3.30	3.30	0.23 J	0.52 J	0.52 J	0.50 U	0.50 U
R1-110	BR	1.60	1.70	2.50	1.90	2.70	3.10	3.20	NS	2.00	NS	2.00	1.00	1.52	2.10	2.10	1.60	1.60	2.50	3.50	2.70
R1-110-2	BR	0.23 J	0.42 J	0.28 J	1.00 U	1.00 U	2.90	1.20	NS	2.00	NS	2.00	1.00	1.01	1.80	1.70	1.10	1.20	1.20	0.50 U	0.50 U
R1-111	BR	1.30	0.90 J	1.10	0.90 J	0.84 J	1.30	1.00 U	5.00 U	1.00	1.00 J	1.00	0.90 J	NS	1.00 U	1.50	0.61 J	0.65 J	0.67 J	1.70 J	1.80
R1-116	BR	0.16 J	0.15 J	0.13 J	NS	1.00 U	1.00 U	1.00 U	5.00 U	0.20 J	0.10 J	0.10 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.50 U	0.50 U
R2-15	BR	1.60	1.90	2.20	2.40	0.75	3.50	3.30	3.00 J	1.00	1.00 J	0.90 J	0.60 J	0.63 J	1.00 U	0.64 J	0.43 J	0.46 J	0.60 J	NS	NS
R2-23	BR	0.18 J	0.21 J	0.27 J	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	0.20 J	NS	0.10 J	0.20 J	0.21 J	NS	1.00 U	0.25 J	1.00 U	0.50 U	0.50 U
ON3	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	0.90 J	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.50 U	NS

Notes:
µ/L = Micrograms per liter
BR = Bedrock Aquifer
GT = Glacial Till Aquifer
J = Indicates sample results between the Method Detection Limit and Contract Required Detection Limit
L = Results biased low.
MCL = (Safe Drinking Water Act) Maximum Contaminant Level
NS = Not sampled
U = Less than the detection limit provided
PCE = Tetrachloroethene
Highlight equivalent to or exceeds MCL

Table A10-1 Historical OU-1 Monitor/Residential Well Sampling Well Program Groundwater Sampling Results for cis-1,2-DCE																					
Well ID	**Aquifer**	**Oct-01 (µg/L)**	**Apr-02 (µg/L)**	**Oct-02 (µg/L)**	**Apr-03 (µg/L)**	**Oct-03 (µg/L)**	**Apr-04 (µg/L)**	**Oct-04 (µg/L)**	**Apr-05 (µg/L)**	**Oct-05 (µg/L)**	**Apr-06 (µg/L)**	**Oct-06 (µg/L)**	**Apr-07 (µg/L)**	**Dec-08 (µg/L)**	**Nov-09 (µg/L)**	**Nov-10 (µg/L)**	**Nov-11 (µg/L)**	**Oct-12 (µg/L)**	**Oct-13 (µg/L)**	**Jul-15 (µg/L)**	**Oct-15 (µg/L)**
MCL		70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
MW01	BR	**100.00**	27.00	14.00	3.90	3.60	16.00	4.60	6.00	11.00	5.00	1.00 U	2.00	3.04	3.70	3.60	2.80	3.70	1.20	0.97 J	3.60
MW02	GT	1.00 U	0.19 J	1.00 U	1.20	0.26	1.00 U	2.00	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW03	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW05	BR	0.11 J	0.99 J	0.18 J	1.00 U	0.65 J	0.79 J	1.00	5.00 U	1.00	0.80 J	1.00 U	0.50 J	0.53 J	0.61 J	0.61 J	0.42 J	0.36 J	0.28 J	0.25 U	0.25 U
MW07	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW08	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW11	GT	5.70	4.50	4.90	4.50	3.30	5.60	3.90	4.00 J	4.00	2.00	1.00 U	2.00	2.69	2.10	3.60	1.60	1.70	1.70	2.10	1.80
MW12	GT	NS	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 UL	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW13	GT	6.10	5.10	13.00	0.64 J	0.76 J	0.72 J	2.00	5.00 U	5.00	0.80 J	1.00 U	1.00	5.97	8.60	5.00	2.10	5.00	1.40	0.86 J	1.30
MW14	BR	1.10	0.94 J	0.94 J	1.80	1.60	1.20	1.90	1.00 J	6.00	0.90 J	1.00 U	1.00	2.93	1.20	1.10	0.35 J	0.72 J	0.58 J	1.30	0.99 J
MW17	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW18	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW19	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW21	BR	0.450 J	00.61 J	0.71 J	0.39 J	0.48 J	1.00 U	0.60 J	5.00 U	0.60 J	0.40 J	1.00 U	0.20 J	0.20 J	1.00 U	0.25 J	0.25 J	1.00 U	1.00 U	0.25 U	0.25 U
MW22	BR	0.790 J	2.00	1.60	1.50	2.40	0.93 J	2.30	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW23	BR	0.023 J	0.13 J	0.099 J	0.34 J	0.41 J	1.00 U	1.00 U	5.00 U	0.60 J	0.50 J	1.00 U	0.30 J	0.50 J	0.53 J	0.73 J	0.44 J	0.41 J	0.49 J	0.26 J	0.20 J
R1-82	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	NS	NS
R1-94	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS
R1-102	BR	1.00	1.40	1.20	0.88 J	0.81 J	0.87 J	1.00 U	NS	0.90 J	NS	1.00 U	3.00	0.64 J	0.80 J	0.80 J	0.82 J	0.51 J	0.54 J	2.30	2.60
R1-103	BR	0.33 J	0.55 J	0.24 J	0.76 J	0.24 J	1.00 U	0.81 J	NS	0.30 J	NS	1.00 U	0.20 J	1.00 UJ	1.00 U	0.26 J	0.36 J	0.24 J	0.30 J	0.25 U	0.38 J
R1-105	BR	0.40 J	0.34 J	0.49 J	0.30 J	0.38 J	NS	1.00 U	NS	0.30 J	NS	1.00 U	0.20 J	NS	1.00 U	0.35 J	0.37 J	0.38 J	1.00 U	NS	NS
R1-109	BR	0.34 J	0.29 J	0.26 J	0.26 J	0.39 J	1.00 U	1.00 U	NS	0.40 J	NS	1.00 U	0.20 J	1.00 U	1.00 U	1.00 U	0.33 J	1.00 U	0.30 J	0.25 U	0.25 U
R1-110	BR	0.57 J	0.67 J	0.55 J	0.48 J	0.55 J	0.61 J	0.63 J	NS	0.80 J	NS	1.00 U	0.40 J	0.30 J	0.38 J	0.43 J	0.30 J	1.00 U	1.00 U	0.25 U	0.25 U
R1-110-2	BR	0.13 J	0.23 J	0.16 J	1.00 U	1.00 U	0.94 J	1.00 U	NS	0.90 J	NS	1.00 U	0.40 J	0.40 J	0.65 J	0.61 J	0.45 J	0.39 J	0.38 J	0.25 U	0.25 U
R1-111	BR	0.14 J	0.37 J	0.33 J	0.34 J	0.27 J	1.00 U	1.00 U	5.00 U	0.50 J	0.40 J	1.00 U	0.30 J	NS	1.00 U	1.00 U	0.32 J	0.25 J	0.24 J	0.25 U	0.25 U
R1-116	BR	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R2-15	BR	0.10 J	0.16 J	0.089 J	1.00 U	0.24 J	1.00 U	1.00 U	5.00 U	0.20 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS
R2-23	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
ON3	BR	2.80	2.40	2.40	1.90	1.80	1.70	1.70	NS	2.00 J	NS	1.00 U	0.70 J	1.35	1.10	1.30	0.54 J	0.52 J	0.79 J	1.30 U	NS

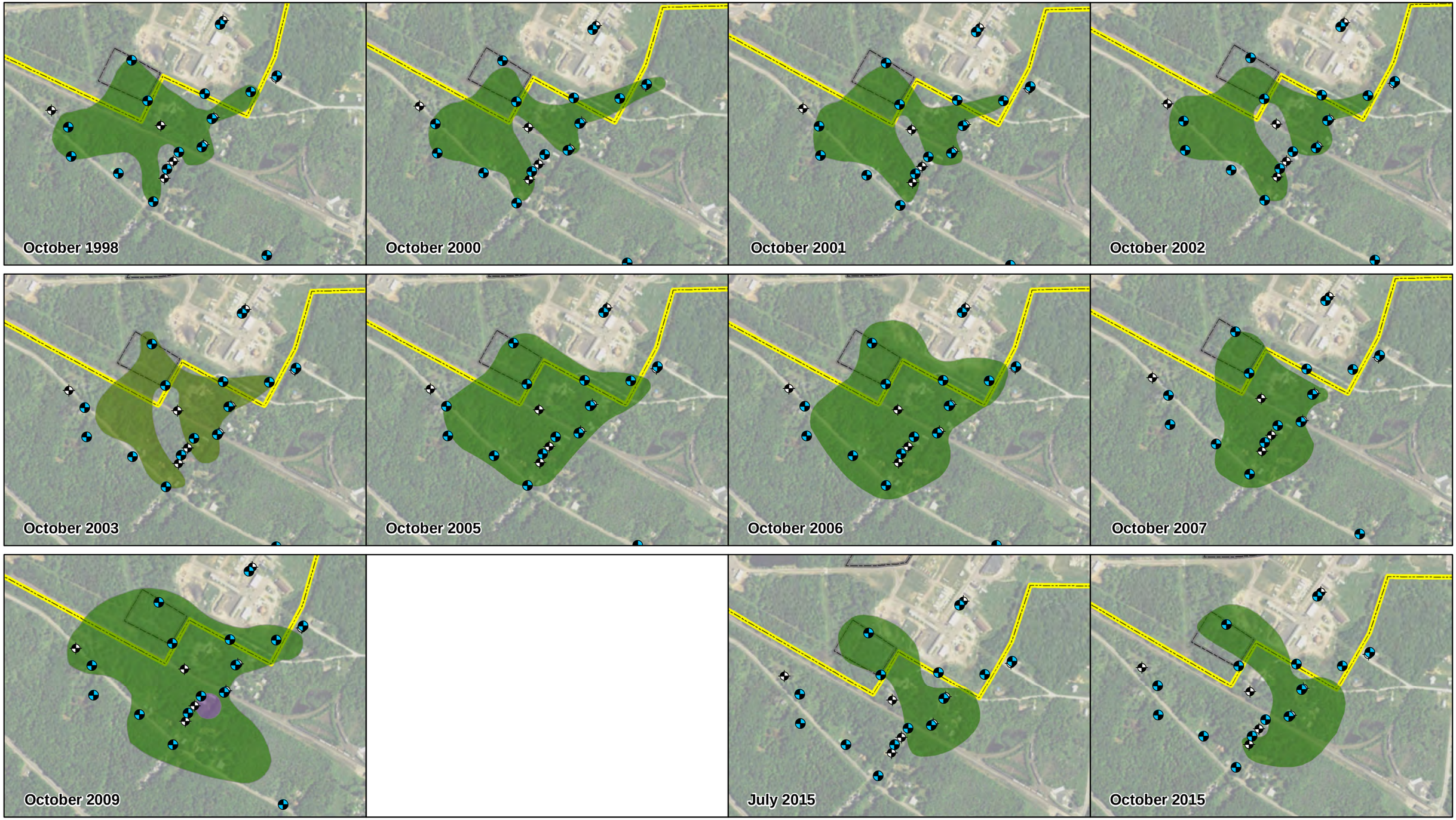
Notes:
µg/L = micrograms per liter
BR = Bedrock aquifer
GT = Glacial till aquifer
J = Indicates sample results between Method Detection Limit and Contract Required Detection Limit
L = Results biased low
MCL = (Safe Drinking Water Act) Maximum Contaminant Level
NS = Not sampled
U = Less than the detection limit provided
cis-1,2-DCE = cis-1,2-Dichloroethene

Highlight/bold equivalent to or exceeds MCL.

Table A10-2 Historical OU-1 Monitor/Residential Well Sampling Well Program Groundwater Sampling Results for trans-1,2-DCE																					
Well ID	**Aquifer**	**Oct-01 (µg/L)**	**Apr-02 (µg/L)**	**Oct-02 (µg/L)**	**Apr-03 (µg/L)**	**Oct-03 (µg/L)**	**Apr-04 (µg/L)**	**Oct-04 (µg/L)**	**Apr-05 (µg/L)**	**Oct-05 (µg/L)**	**Apr-06 (µg/L)**	**Oct-06 (µg/L)**	**Apr-07 (µg/L)**	**Dec-08 (µg/L)**	**Nov-09 (µg/L)**	**Nov-10 (µg/L)**	**Nov-11 (µg/L)**	**Oct-12 (µg/L)**	**Oct-13 (µg/L)**	**Jul-15 (µg/L)**	**Oct-15 (µg/L)**
MCL		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
MW01	BR	3.30	0.91J	0.87 J	0.14 J	0.14 J	0.72 J	1.00 U	5.00 U	0.80 J	0.30 J	1.00 U	1.00 U	1.00 U	0.41 J	0.17 J	1.00 U	1.00 U	1.00 U	0.25 U	0.22 J
MW02	GT	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW03	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW05	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 UL	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW07	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW08	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW11	GT	0.073 J	1.00 U	0.098 J	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW12	GT	NS	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 UL	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW13	GT	0.26 J	0.17	0.31 J	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW14	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	0.20 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW17	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW18	GT	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW19	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW21	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
MW22	BR	1.00 U	1.00 U	0.092 J	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW23	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-82	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	NS	NS
R1-94	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS
R1-102	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-103	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-105	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS
R1-109	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-110	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-110-2	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-111	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R1-116	BR	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
R2-15	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS
R2-23	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	NS	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
ON3	BR	2.80	0.07 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.30 U	NS

Notes:
µg/L = micrograms per liter
BR = Bedrock aquifer
GT = Glacial till aquifer
J = Indicates sample results between Method Detection Limit and Contract Required Detection Limit
L = Results biased low
MCL = (Safe Drinking Water Act) Maximum Contaminant Level
NS = Not sampled
U = Less than the detection limit provided
trans-1,2-DCE = trans-1,2-Dichloroethene

Highlight/bold equivalent to or exceeds MCL.



Bedrock Well
Residential Well
1 ppb
5 ppb
Institutional Control Boundary
Tobyhanna Army Depot Boundary

N
W E
S

Note: Plume delineations were completed by EA Engineering, Science, and Technology, Inc., PBC

0 140280 560
Feet

US Army Corps of Engineers
Buffalo District

OU-1 PCE Plume in Bedrock

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Five Year Review
Tobyhanna Army Depot
Tobbyhanna, PA

Figure A10 - 1

Table 2-8
OU-1 PCE Plume Area as a Function of Time

1 ppb PCE CONTOUR			5 ppb PCE CONTOUR		
Date	Plume Area (ft^2)	Percent of Original Plume Area	Date	Plume Area (ft^2)	Percent of Original Plume Area
Jan-88	3,337,800	100%	Jan-88	1,119,750	100%
Aug-88	3,304,820	99%	Aug-88	1,817,800	162%
Dec-88	1,950,200	58%	Dec-88	1,111,700	99%
Mar-89	1,920,400	58%	Mar-89	986,100	88%
Jun-89	2,237,900	67%	Jun-89	1,141,680	102%
Dec-89	2,098,500	63%	Dec-89	896,800	80%
Jul-90	1,984,000	59%	Jul-90	909,250	81%
Oct-90	1,733,400	52%	Oct-90	735,000	66%
Feb-93	2,289,000	69%	Feb-93	436,100	39%
Mar-94	1,062,300	32%	Mar-94	329,600	29%
Sep-94	1,110,890	33%	Sep-94	413,300	37%
Mar-96	1,080,000	32%	Mar-96	0	0%
Sep-96	985,000	30%	Sep-96	0	0%
Apr-97	1,212,500	36%	Apr-97	0	0%
Sep-97	864,130	26%	Sep-97	0	0%
Apr-98	840,200	25%	Apr-98	0	0%
Oct-98	884,213	26%	Oct-98	0	0%
Apr-99	739,500	22%	Apr-99	0	0%
Apr-00	880,790	26%	Apr-00	0	0%
Oct-00	867,370	26%	Oct-00	0	0%
Apr-01	859,320	26%	Apr-01	0	0%
Oct-01	831,550	25%	Oct-01	0	0%
Apr-02	954,181	29%	Apr-02	0	0%
Oct-02	887,221	27%	Oct-02	0	0%
Apr-03	848,162	25%	Apr-03	0	0%
Oct-03	736,561	22%	Oct-03	0	0%
Apr-04	1,396,832	42%	Apr-04	22,320	2%
Oct-04	1,596,388	48%	Oct-04	0	0%
Apr-05	891,277	27%	Apr-05	0	0%
Oct-05	1,364,252	41%	Oct-05	0	0%
Apr-06	1,235,931	37%	Apr-06	0	0%
Oct-06	1,531,904	46%	Oct-06	0	0%
Apr-07	888,624	27%	Apr-07	0	0%
Dec-08	1,254,359	38%	Dec-08	0	0%
Nov-09	1,910,815	57%	Nov-09	37,957	3%
Nov-10	1,925,856	58%	Nov-10	0	0%
Nov-11	1,043,494	31%	Nov-11	0	0%
Oct-12	1,322,698	40%	Oct-12	0	0%
Oct-13	1,322,698	40%	Oct-13	0	0%
Jul-15	656,449	20%	Jul-15	0	0%
Oct-15	1,248,009	37%	Oct-15	0	0%

Notes:

..... Dotted line represents the change in sampling methodology in October 2004.

% = percent
ppb = parts per billion
PCE = Tetrachloroethene
ft^2 = Square feet

October 1998

October 2000

October 2001

October 2002

October 2003

October 2004

October 2005

October 2006

October 2007

October 2009

July 2015

October 2015

Bedrock Well

Residential Well

10 ppb

5 ppb

1 ppb

Institutional Control Boundary

Tobyhanna Army Depot Boundary

N

W E

S

Note: Plume delineations were completed by
EA Engineering, Science, and Technology, Inc., PBC

0 1,250 2,500

Feet

US Army Corps of Engineers
Buffalo District

OU-1 TCE Plume in Bedrock

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Five Year Review
Tobyhanna Army Depot
Tobbyhanna, PA

Figure A10 - 2

Table 2-7 OU-1 TCE Plume Area as a Function of Time

1 ppb TCE CONTOUR			5 ppb TCE CONTOUR		
Date	Plume Area (ft^2)	Percent of Original Plume Area	Date	Plume Area (ft^2)	Percent of Original Plume Area
Jan-88	7,191,000	100%	Jan-88	2,006,300	100%
Aug-88	5,330,985	74%	Aug-88	1,782,360	89%
Dec-88	4,885,800	68%	Dec-88	1,922,380	96%
Mar-89	5,096,600	71%	Mar-89	1,561,790	78%
Jun-89	4,657,180	65%	Jun-89	1,932,360	96%
Dec-89	5,266,200	73%	Dec-89	1,823,400	91%
Jul-90	5,892,800	82%	Jul-90	1,826,300	91%
Oct-90	5,633,200	78%	Oct-90	1,842,300	92%
Feb-93	4,364,900	61%	Feb-93	1,460,700	73%
Mar-94	3,465,218	48%	Mar-94	1,408,444	70%
Sep-94	3,903,950	54%	Sep-94	1,496,230	75%
Mar-96	2,890,000	40%	Mar-96	691,500	34%
Sep-96	2,995,000	42%	Sep-96	860,000	43%
Apr-97	2,315,000	32%	Apr-97	367,500	18%
Sep-97	2,585,900	36%	Sep-97	449,500	22%
Apr-98	1,978,000	28%	Apr-98	189,500	9%
Oct-98	1,934,500	27%	Oct-98	284,000	14%
Apr-99	1,725,700	24%	Apr-99	236,000	12%
Apr-00	2,416,900	34%	Apr-00	139,000	7%
Oct-00	2,394,900	33%	Oct-00	133,600	7%
Apr-01	2,131,600	30%	Apr-01	120,900	6%
Oct-01	2,129,900	30%	Oct-01	142,000	7%
Apr-02	2,120,404	29%	Apr-02	150,660	8%
Oct-02	2,192,944	30%	Oct-02	39,060	2%
Apr-03	1,953,003	27%	Apr-03	33,480	2%
Oct-03	1,422,902	20%	Oct-03	89,280	4%
Apr-04	2,410,564	34%	Apr-04	552,421	28%
Oct-04	2,441,231	34%	Oct-04	672,103	33%
Apr-05	2,777,174	39%	Apr-05	632,594	32%
Oct-05	2,942,587	41%	Oct-05	741,285	37%
Apr-06	2,449,456	34%	Apr-06	508,407	25%
Oct-06	2,835,849	39%	Oct-07	875,649	44%
Apr-07	2,952,932	41%	Apr-07	113,256	6%
Dec-08	3,764,516	52%	Dec-08	390,905	19%
Nov-09	3,428,968	48%	Nov-09	362,940	18%
Nov-10	3,640,765	51%	Nov-10	491,600	25%
Nov-11	2,600,188	36%	Nov-11	322,258	16%
Oct-12	2,593,163	36%	Oct-12	347,398	17%
Oct-13	2,609,600	36%	Oct-13	262,551	13%
Jul-15	2,156,220	30%	Jul-15	0	0%
Oct-15	1,516,326	21%	Oct-15	0	0%

Notes:

..... Dotted line represents the change in sampling methodology in October 2004.

% = percent
ppb = parts per billion
TCE = Trichloroethene
ft^2 = Square feet

Table 2-7 OU-1 TCE Plume Area as a Function of Time

Date	Plume Area (ft^2) 5 ppb TCE	Plume and Rock Volume (ft^3) Thickness = 100 ft	Plume and Rock Volume (gallons)	Plume Volume at Effective Porosity (5%)	Plume Volume at Effective Porosity (10%)	Plume Volume at Effective Porosity (15%)
Jan-88	2,006,300	200,630,000	1,500,913,030	75,045,652	150,091,303	225,136,955
Oct-15	0	0	0	0	0	0
Difference	2,006,300	200,630,000	1,500,913,030	75,045,652	150,091,303	225,136,955

Notes:
ft = Feet
ft^2 = Square feet
ft^3 = Cubic feet
% = Percent
ppb = Parts per billion
TCE = Trichloroethene

FIGURE 2-5

TYAD OU-1 TCE and PCE Groundwater Plume Areas Over Time

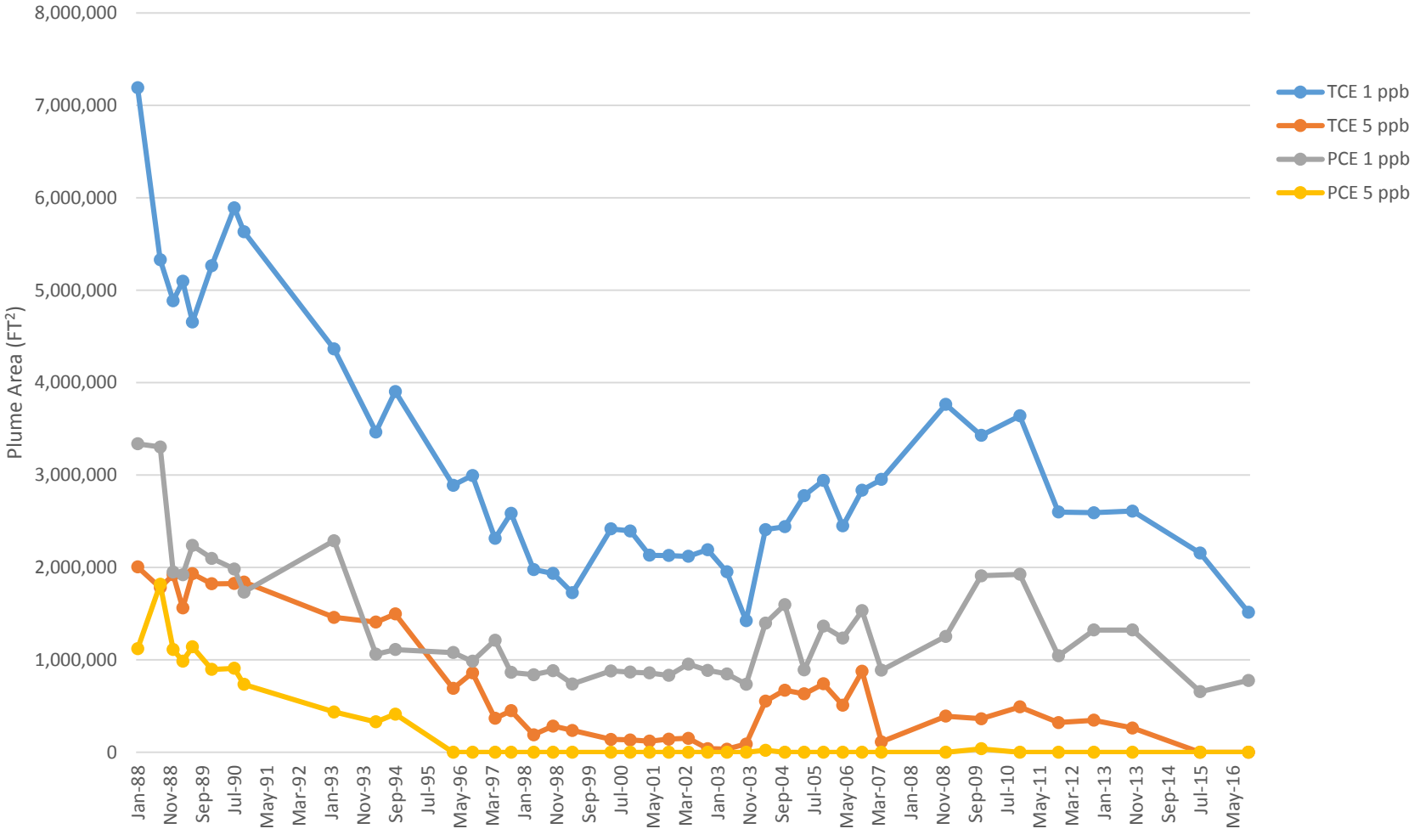

Table 2-6 OU-1 Wells Exceeding Maximum Contaminant Levels*

Well Category		No. Exceeding MCLs				
		Bedrock Monitoring	Onsite Water Supply	Glacial Till Monitoring	Offsite Residential	Total
1987		6	1	4	12	23
1994		3	1	2	5	11
1996	Spring	3	1	1	2	7
	Fall	3	0	1	3	7
1997	Spring	2	0	1	2	5
	Fall	3	1	2	2	8
1998	Spring	2	0	1	2	5
	Fall	3	0	2	2	7
1999	Spring	2	0	1	2	5
	Fall	NA	NA	NA	NA	0
2000	Spring	2	0	2	3	7
	Fall	1	0	1	2	4
2001	Spring	1	0	1	2	4
	Fall	1	0	2	2	5
2002	Spring	2	0	2	1	5
	Fall	1	0	2	3	6
2003	Spring	2	0	1	1	4
	Fall	2	0	1	3	6
2004	Spring	4	0	1	7	12
	Fall	1	0	1	1	3
2005	Spring	2	0	1	0	3
	Fall	4	0	2	5	11
2006	Spring	3	0	1	0	4
	Fall	3	0	2	5	10
2007	Spring	1	0	1	1	3
2008	Fall	2	0	2	2	6
2009	Fall	2	0	2	3	7
2010	Fall	6	0	2	6	14
2011	Fall	2	0	1	2	5
2012	Fall	2	0	2	2	6
2013	Fall	1	0	1	1	3
2015	Summer	0	0	1	0	1
	Fall	0	0	1	0	1

Notes:
* Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for 1,2-DCE, vinyl chloride, PCE, and TCE.
NA = Not available (no sampling conducted due to drought).
No. = Number

A10-3. TYAD Field Measurements at OU-1

Well	Date	pH (s.u.)	Cond (µs/cm)	Temp ºC	ORP mV	DO mg/L	Notes
MW01	10/21/2015	6.14	0.582	11.03	197	0	
MW05	10/21/2015	5.28	6.115	10.02	221	0.4	
MW11	10/21/2015	5.23	0.326	11.38	266	0	
MW12	10/20/2015	5.24	6.394	14.87	201	0.34	
MW13	10/21/2015	5.85	6.336	14.08	152	1.54	
MW14	10/21/2015	5.91	0.436	16.97	168	1.97	
MW21	10/20/2015	11.46	0.265	10.4	6	3.81	Possible grout contamination
MW23	10/21/2015	5.52	0.101	16.51	271	0.37	
R1-102	10/22/2015	6.57	0.414	11.01	197	0	Not allowed to stabilize
R1-103	10/22/2015	7.2	0.134	17.6	124	2.83	Not allowed to stabilize
R1-109	10/22/2015	7.12	0.001	13.92	183	10.96	Not allowed to stabilize, DO above saturation limit
R1-110	10/22/2015	5.74	0.561	17.24	236	0	Not allowed to stabilize
R1-110-2	10/22/2015	7.15	0.074	11.35	150	7.84	Not allowed to stabilize
R1-111	10/22/2015	6.42	0.455	18.56	198	1.16	Not allowed to stabilize
R1-116	10/22/2015	5.92	0.036	21.19	189	1.91	Not allowed to stabilize
R2-23	10/21/2015	5.24	0.065	15.51	286	2.06	Not allowed to stabilize
ON-3	10/22/2015	NM	NM	NM	NM	NM	

Notes:
µs/cm = microsiemens per centimeter
ºC = degrees Celsius
Cond = conductivity
DO = dissolved oxygen
mg/L = milligrams per liter
mV = millivolts
s.u. = standard units

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OU-1 Areas A and B Trend Analysis

The Mann-Kendall test, described in the EPA document: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (USEPA, March 2009) and USACE Engineer Manual: Environmental Quality – Environmental Statistics (USACE, May 2013), is an accepted method for identifying the presence of significant monotonic trends in monitoring well concentration data.

Under this method, the null hypothesis assumes that no discernible linear trend exists in concentration data over time. To test this hypothesis, the Mann-Kendall statistic (test statistic) is determined. The test statistic is a function of the sample data which quantifies the probability associated with the relative magnitudes of the sample data for a given sample size (n). The significance of this probability is determined by comparison to the critical value, a threshold value of statistical significance. Under the normal approximation to the Mann-Kendall test for large sample sizes (n>10), the critical value is determined based on a 95% level of confidence associated with the standard normal distribution. When testing for an upward trend, if the test statistic exceeds the critical value, the null hypothesis is rejected and the alternative hypothesis (upward trend) is accepted. When testing for a downward trend, if the test statistic is less than the critical value, the null hypothesis is rejected and the alternative hypothesis (downward trend) is accepted. For the Mann-Kendall test for small sample sizes (n<=10), the null hypothesis is rejected if the test statistic is less than the critical value. Rejection of the null hypothesis is considered to be strong evidence of either an upward or downward trend; if the null hypothesis is not rejected there is insufficient evidence for identifying a significant, non-zero trend.

TCE and PCE groundwater concentrations in monitoring wells associated with OU-1 were subjected to the Mann-Kendall test to determine if any monitoring well shows a statistically significant trend in concentration. If a significant amount of data was censored (non-detects or J-qualified data), trend evaluation was not performed for that well because the test loses statistical power.

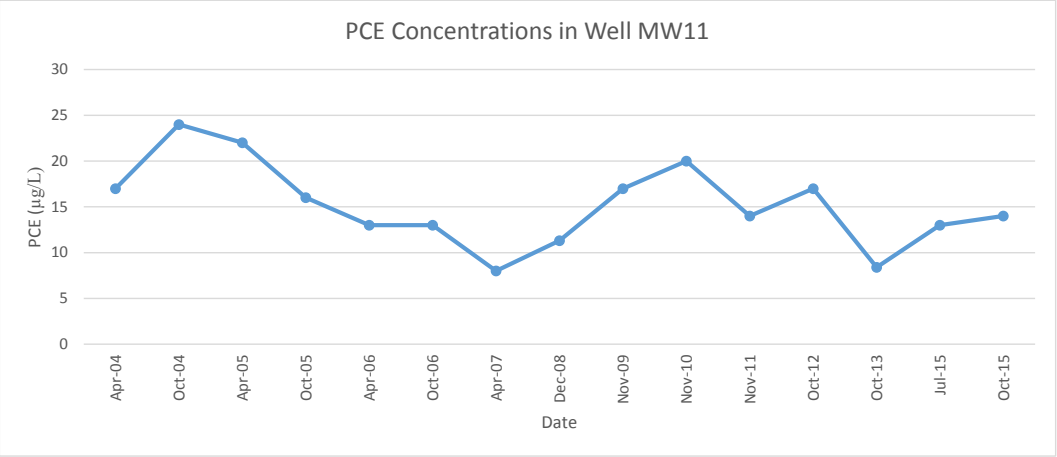
The Mann-Kendall test was performed for PCE concentrations at 11 monitoring wells. A downward trend was identified in 6 wells and no trend was identified for the other 5 wells. The following table presents the results of the PCE concentration trend evaluation.

PCE Trends in OU-1 Monitoring Wells

Well	Aquifer	Test Statistic	Critical Value	Trend
MW11	Glacial till	-1.607	-1.64	No trend
MW12	Glacial till	0.577	1.64	No trend
MW13	Glacial till	1.065	1.64	No trend
MW14	Bedrock	-0.953	-1.64	No trend
MW23	Bedrock	-1.962	-1.64	Downward
R1-102	Bedrock	-2.638	-1.64	Downward
R1-103	Bedrock	-3.344	-1.64	Downward
R1-105	Bedrock	0.344	0.05	No trend
R1-109	Bedrock	-1.646	-1.64	Downward
R1-110	Bedrock	0.683	1.64	No trend
R1-110-2	Bedrock	-2.843	-1.64	Downward

The Mann-Kendall test was performed for TCE concentrations at 15 monitoring wells. A downward trend was identified in 8 wells and no trend was identified for the other 7 wells. The following table presents the results of the TCE concentration trend evaluation.

TCE Trends in OU-1 Monitoring Wells				
Well	**Aquifer**	**Test Statistic**	**Critical Value**	**Trend**
MW01	Bedrock	-2.581	-1.64	Downward
MW05	Bedrock	-1.753	-1.64	Downward
MW11	Glacial till	-3.816	-1.64	Downward
MW13	Glacial till	0.962	1.64	No trend
MW14	Bedrock	-0.346	-1.64	No trend
MW21	Bedrock	-0.456	-1.64	No trend
MW23	Bedrock	-3.163	-1.64	Downward
ON3	Bedrock	-1.279	-1.64	No trend
R1-102	Bedrock	-2.353	-1.64	Downward
R1-103	Bedrock	-3.494	-1.64	Downward
R1-105	Bedrock	0.381	0.05	No trend
R1-109	Bedrock	-0.683	-1.64	No trend
R1-110	Bedrock	-3.475	-1.64	Downward
R1-110-2	Bedrock	-2.687	-1.64	Downward
R1-111	Bedrock	-1.065	-1.64	No trend



Date	µg/L
Apr-04	17
Oct-04	24
Apr-05	22
Oct-05	16
Apr-06	13
Oct-06	13
Apr-07	8
Dec-08	11.3
Nov-09	17
Nov-10	20
Nov-11	14
Oct-12	17
Oct-13	8.4
Jul-15	13
Oct-15	14

Mann-Kendall Test Using Normal Approximation for Larger Samples

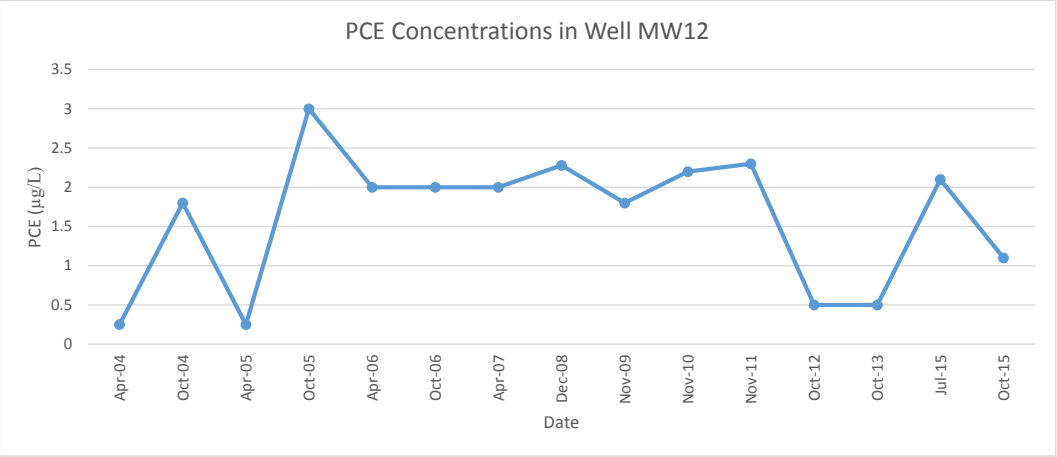
n	15
S	-28
g	7
w	2
V(s)	282.3333
z	-1.606877
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	0.25
Oct-04	1.8
Apr-05	0.25
Oct-05	3
Apr-06	2
Oct-06	2
Apr-07	2
Dec-08	2.28
Nov-09	1.8
Nov-10	2.2
Nov-11	2.3
Oct-12	0.5
Oct-13	0.5
Jul-15	2.1
Oct-15	1.1

Mann-Kendall Test Using Normal Approximation for Larger Samples

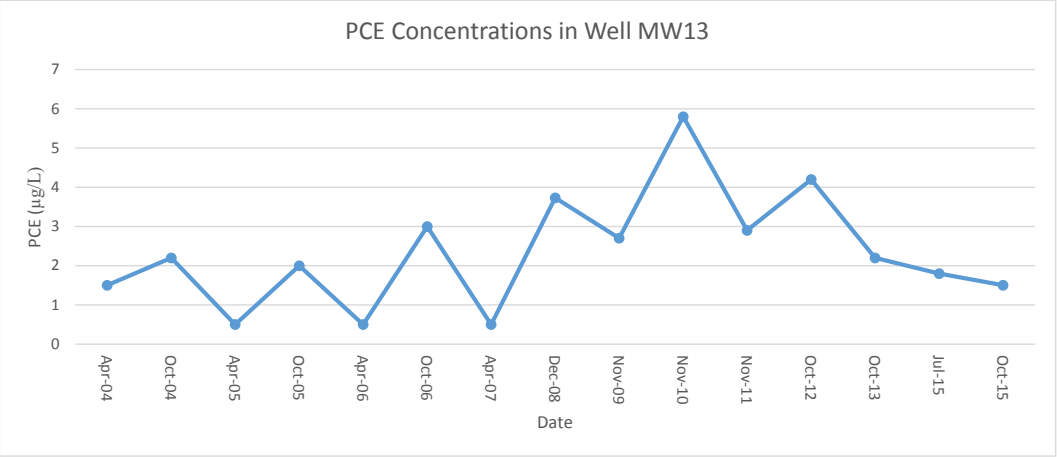
n	15
S	9
g	6
w	2
V(s)	300.3333
z	0.57703
Z(0.95)	1.64

Ho: No trend

Ha: Upward trend

Reject Ho if z>Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	1.5
Oct-04	2.2
Apr-05	0.5
Oct-05	2
Apr-06	0.5
Oct-06	3
Apr-07	0.5
Dec-08	3.73
Nov-09	2.7
Nov-10	5.8
Nov-11	2.9
Oct-12	4.2
Oct-13	2.2
Jul-15	1.8
Oct-15	1.5

Mann-Kendall Test Using Normal Approximation for Larger Samples

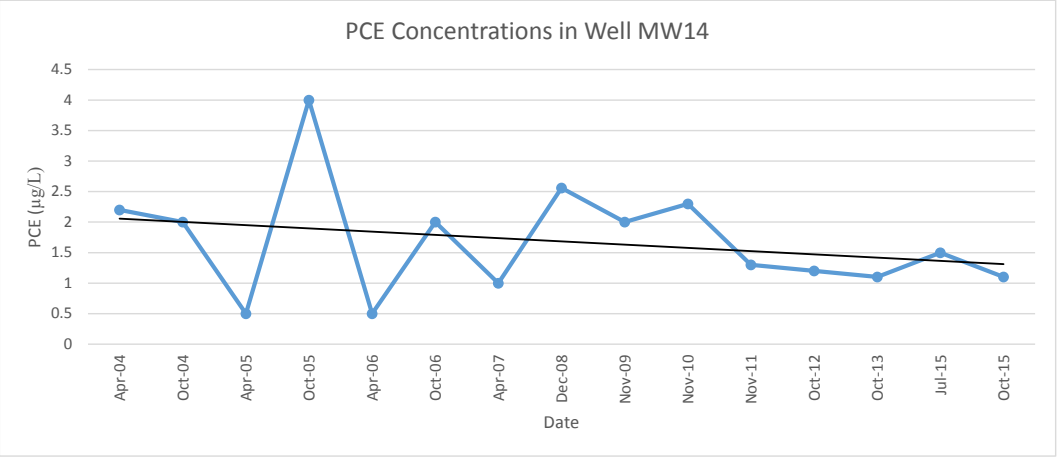
n	15
S	18
g	5
w	2
V(s)	318.3333
z	1.064909
Z(0.95)	1.64

Ho: No trend

Ha: Upward trend

Reject Ho if z>Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	2.2
Oct-04	2
Apr-05	0.5
Oct-05	4
Apr-06	0.5
Oct-06	2
Apr-07	1
Dec-08	2.56
Nov-09	2
Nov-10	2.3
Nov-11	1.3
Oct-12	1.2
Oct-13	1.1
Jul-15	1.5
Oct-15	1.1

Mann-Kendall Test Using Normal Approximation for Larger Samples

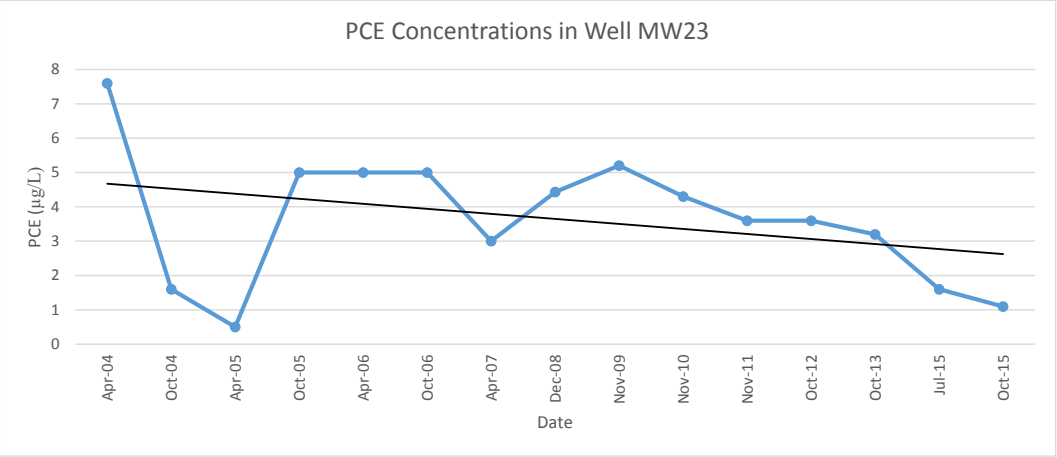
n	15
S	-18
g	5
w	2
V(s)	318.3333
z	-0.952813
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	7.6
Oct-04	1.6
Apr-05	0.5
Oct-05	5
Apr-06	5
Oct-06	5
Apr-07	3
Dec-08	4.43
Nov-09	5.2
Nov-10	4.3
Nov-11	3.6
Oct-12	3.6
Oct-13	3.2
Jul-15	1.6
Oct-15	1.1

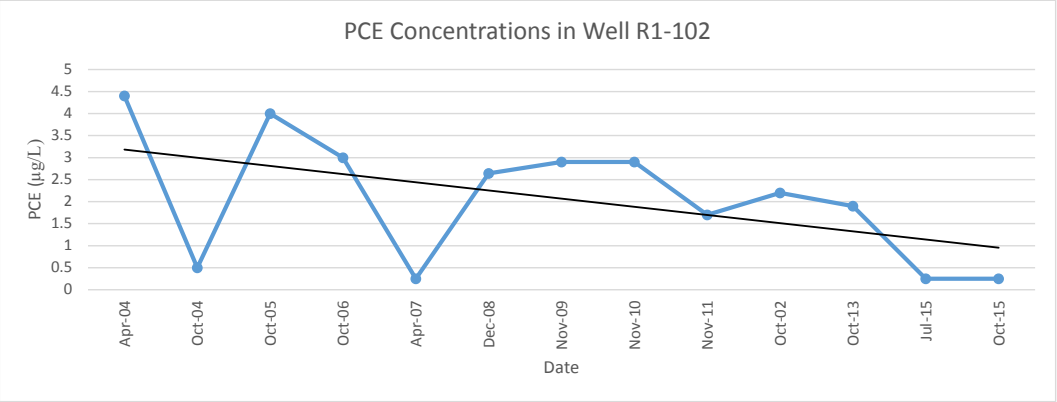
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-36
g	5
w	2
V(s)	318.3333
z	-1.961675
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	4.4
Oct-04	0.5
Oct-05	4
Oct-06	3
Apr-07	0.25
Dec-08	2.64
Nov-09	2.9
Nov-10	2.9
Nov-11	1.7
Oct-02	2.2
Oct-13	1.9
Jul-15	0.25
Oct-15	0.25

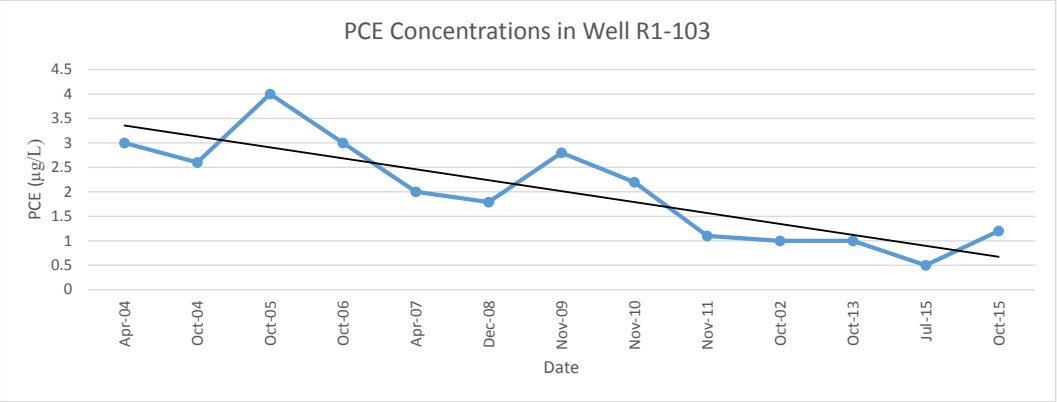
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-38
g	4
w	2
V(s)	196.6667
z	-2.638374
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	3
Oct-04	2.6
Oct-05	4
Oct-06	3
Apr-07	2
Dec-08	1.79
Nov-09	2.8
Nov-10	2.2
Nov-11	1.1
Oct-02	1
Oct-13	1
Jul-15	0.5
Oct-15	1.2

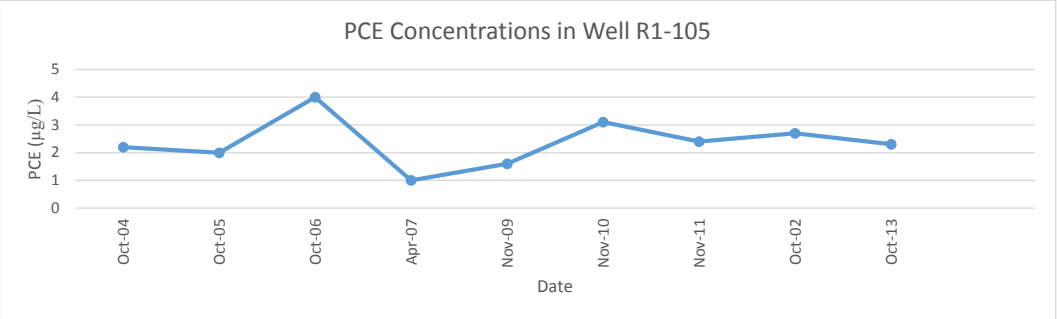
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-52
g	2
w	2
V(s)	232.6667
z	-3.343514
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Oct-04	2.2
Oct-05	2
Oct-06	4
Apr-07	1
Nov-09	1.6
Nov-10	3.1
Nov-11	2.4
Oct-02	2.7
Oct-13	2.3

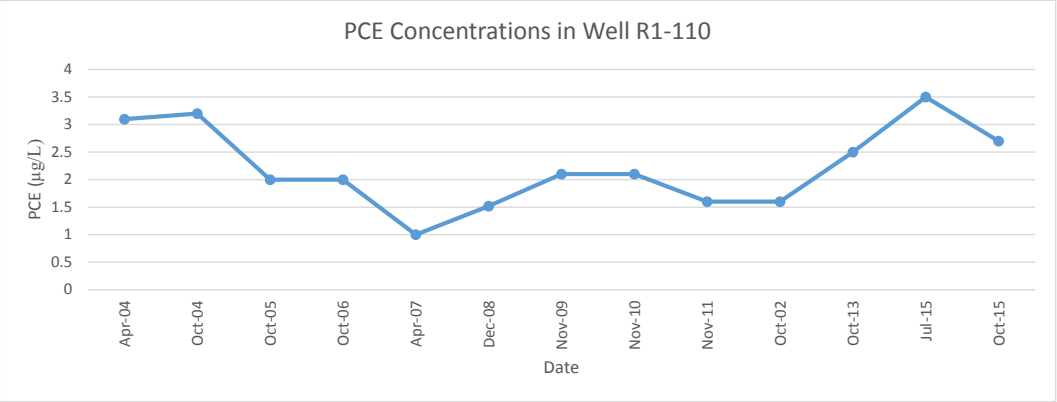
Mann-Kendall Test Using Normal Approximation for Smaller Samples (n<10)

n	9
S	5
p	0.3435
α	0.05

Ho: No trend

Ha: Upward trend

Reject Ho if p<α Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	3.1
Oct-04	3.2
Oct-05	2
Oct-06	2
Apr-07	1
Dec-08	1.52
Nov-09	2.1
Nov-10	2.1
Nov-11	1.6
Oct-02	1.6
Oct-13	2.5
Jul-15	3.5
Oct-15	2.7

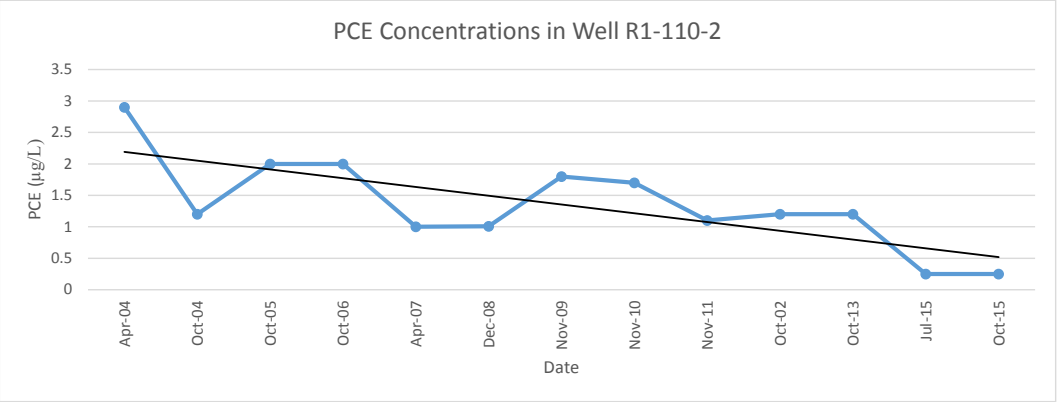
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	9
g	3
w	2
V(s)	214.6667
z	0.682524
Z(0.95)	1.64

Ho: No trend

Ha: Upward trend

Reject Ho if z>Z(0.95) Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	2.9
Oct-04	1.2
Oct-05	2
Oct-06	2
Apr-07	1
Dec-08	1.01
Nov-09	1.8
Nov-10	1.7
Nov-11	1.1
Oct-02	1.2
Oct-13	1.2
Jul-15	0.25
Oct-15	0.25

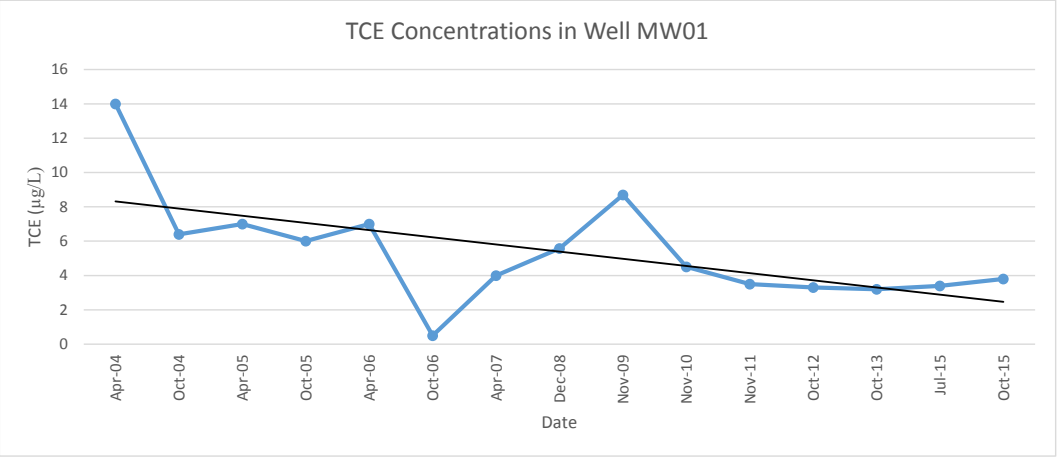
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-39
g	5
w	2
V(s)	178.6667
z	-2.842902
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	14
Oct-04	6.4
Apr-05	7
Oct-05	6
Apr-06	7
Oct-06	0.5
Apr-07	4
Dec-08	5.57
Nov-09	8.7
Nov-10	4.5
Nov-11	3.5
Oct-12	3.3
Oct-13	3.2
Jul-15	3.4
Oct-15	3.8

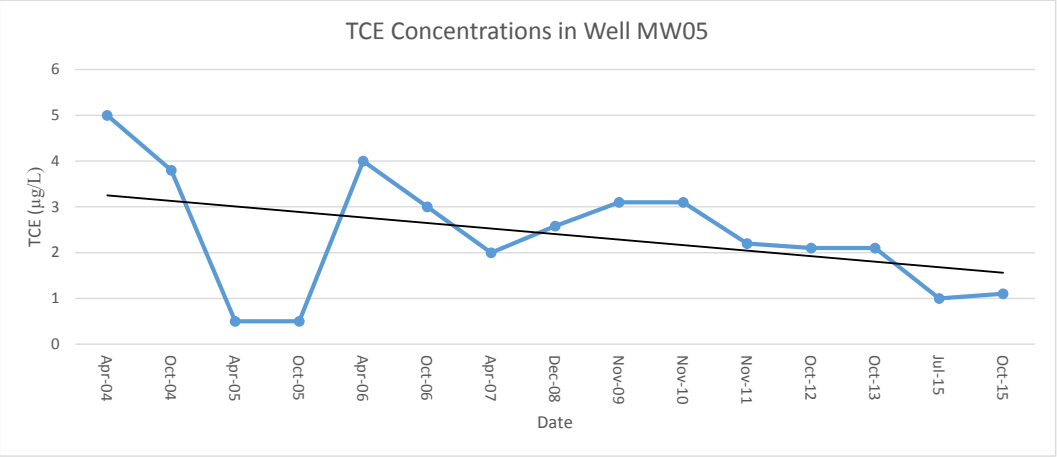
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-52
g	1
w	2
V(s)	390.3333
z	-2.581382
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of an downward trend at the 95% level of confidence



Date	µg/L
Apr-04	5
Oct-04	3.8
Apr-05	0.5
Oct-05	0.5
Apr-06	4
Oct-06	3
Apr-07	2
Dec-08	2.58
Nov-09	3.1
Nov-10	3.1
Nov-11	2.2
Oct-12	2.1
Oct-13	2.1
Jul-15	1
Oct-15	1.1

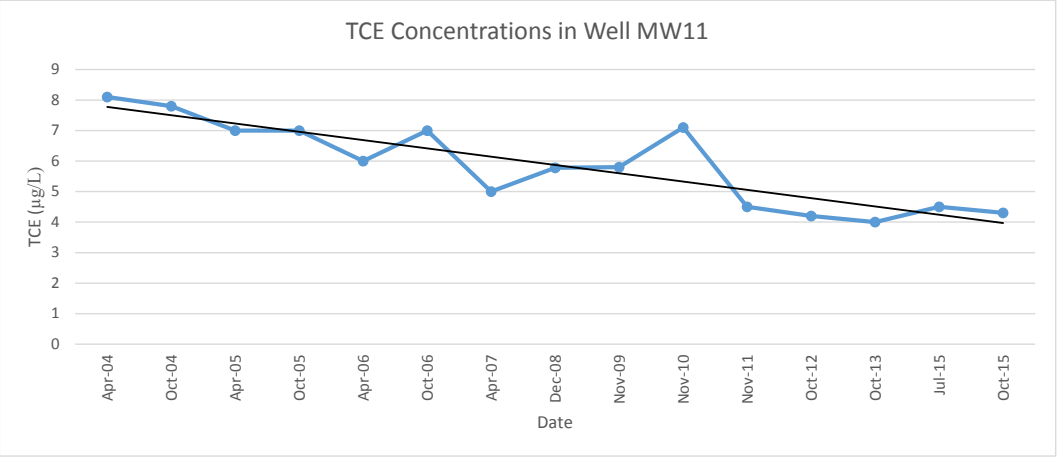
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-34
g	3
w	2
V(s)	354.3333
z	-1.753105
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of an downward trend at the 95% level of confidence



Date	µg/L
Apr-04	8.1
Oct-04	7.8
Apr-05	7
Oct-05	7
Apr-06	6
Oct-06	7
Apr-07	5
Dec-08	5.78
Nov-09	5.8
Nov-10	7.1
Nov-11	4.5
Oct-12	4.2
Oct-13	4
Jul-15	4.5
Oct-15	4.3

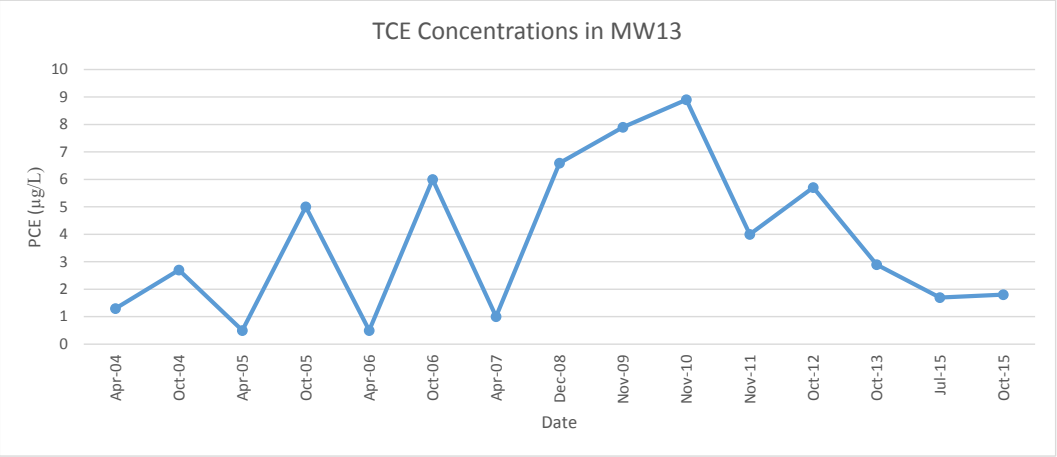
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-71
g	4
w	2
V(s)	336.3333
z	-3.81692
Z(0.95)	-1.64

Ho: No trend

Ha: Upward trend

Reject Ho if z>Z(0.95) Ho is rejected, there is evidence of an downward trend at the 95% level of confidence



Date	µg/L
Apr-04	1.3
Oct-04	2.7
Apr-05	0.5
Oct-05	5
Apr-06	0.5
Oct-06	6
Apr-07	1
Dec-08	6.59
Nov-09	7.9
Nov-10	8.9
Nov-11	4
Oct-12	5.7
Oct-13	2.9
Jul-15	1.7
Oct-15	1.8

Mann-Kendall Test Using Normal Approximation for Larger Samples

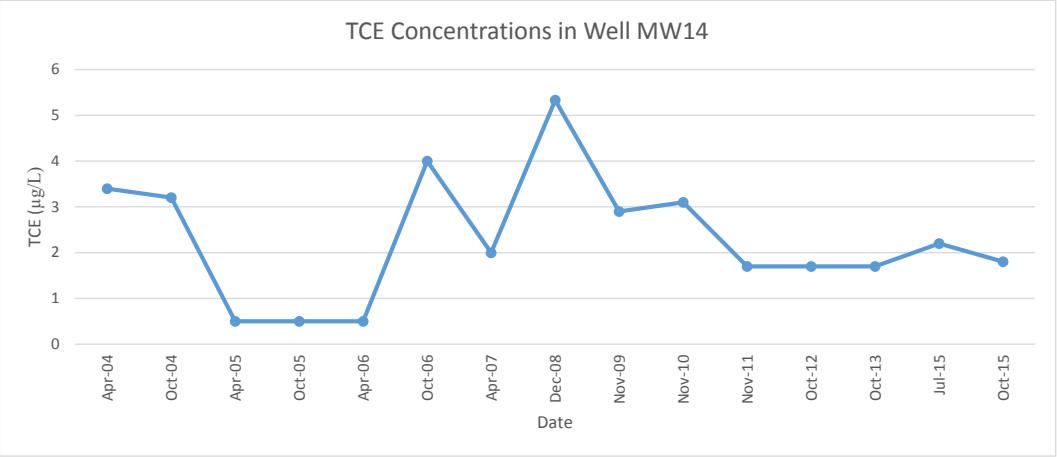
n	15
S	18
g	1
w	2
V(s)	390.3333
z	0.961692
Z(0.95)	1.64

Ho: No trend

Ha: Upward trend

Reject Ho if z>Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	3.4
Oct-04	3.2
Apr-05	0.5
Oct-05	0.5
Apr-06	0.5
Oct-06	4
Apr-07	2
Dec-08	5.33
Nov-09	2.9
Nov-10	3.1
Nov-11	1.7
Oct-12	1.7
Oct-13	1.7
Jul-15	2.2
Oct-15	1.8

Mann-Kendall Test Using Normal Approximation for Larger Samples

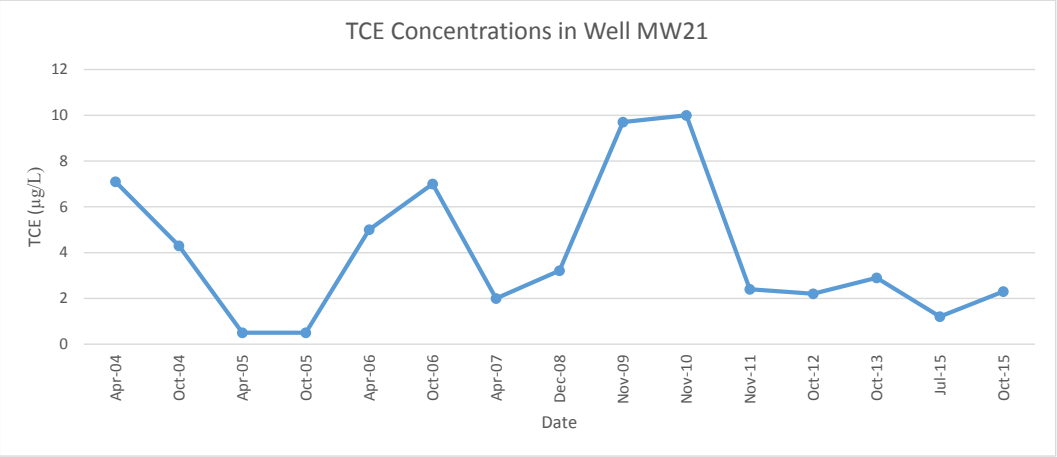
n	15
S	-7
g	6
w	2
V(s)	300.3333
z	-0.346218
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	7.1
Oct-04	4.3
Apr-05	0.5
Oct-05	0.5
Apr-06	5
Oct-06	7
Apr-07	2
Dec-08	3.21
Nov-09	9.7
Nov-10	10
Nov-11	2.4
Oct-12	2.2
Oct-13	2.9
Jul-15	1.2
Oct-15	2.3

Mann-Kendall Test Using Normal Approximation for Larger Samples

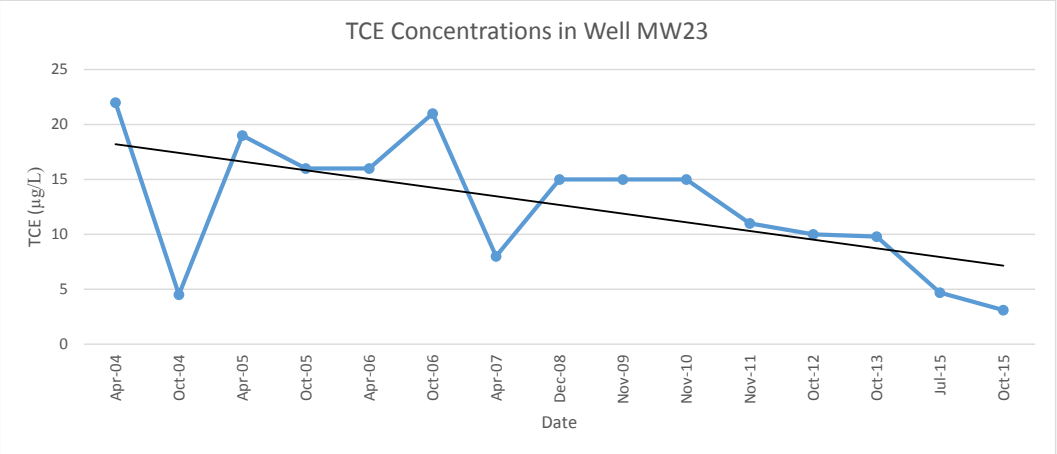
n	15
S	-10
g	1
w	2
V(s)	390.3333
z	-0.455538
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	22
Oct-04	4.5
Apr-05	19
Oct-05	16
Apr-06	16
Oct-06	21
Apr-07	8
Dec-08	15
Nov-09	15
Nov-10	15
Nov-11	11
Oct-12	10
Oct-13	9.8
Jul-15	4.7
Oct-15	3.1

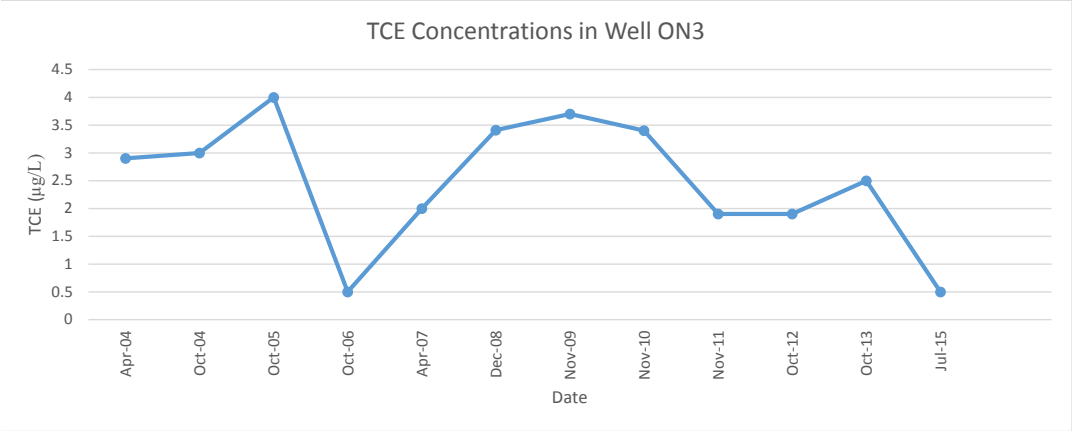
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-59
g	4
w	2
V(s)	336.3333
z	-3.162591
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	2.9
Oct-04	3
Oct-05	4
Oct-06	0.5
Apr-07	2
Dec-08	3.41
Nov-09	3.7
Nov-10	3.4
Nov-11	1.9
Oct-12	1.9
Oct-13	2.5
Jul-15	0.5

Mann-Kendall Test Using Normal Approximation for Larger Samples

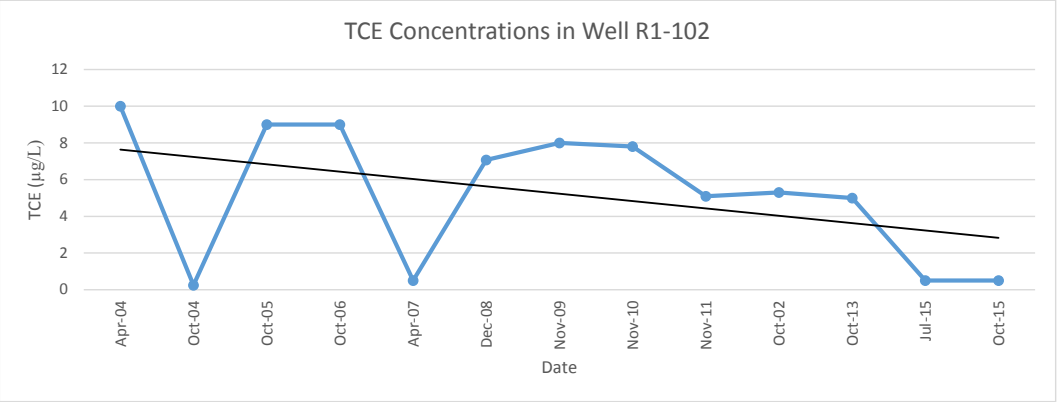
n	12
S	-18
g	2
w	2
V(s)	176.6667
z	-1.279003
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	10
Oct-04	0.25
Oct-05	9
Oct-06	9
Apr-07	0.5
Dec-08	7.07
Nov-09	8
Nov-10	7.8
Nov-11	5.1
Oct-02	5.3
Oct-13	5
Jul-15	0.5
Oct-15	0.5

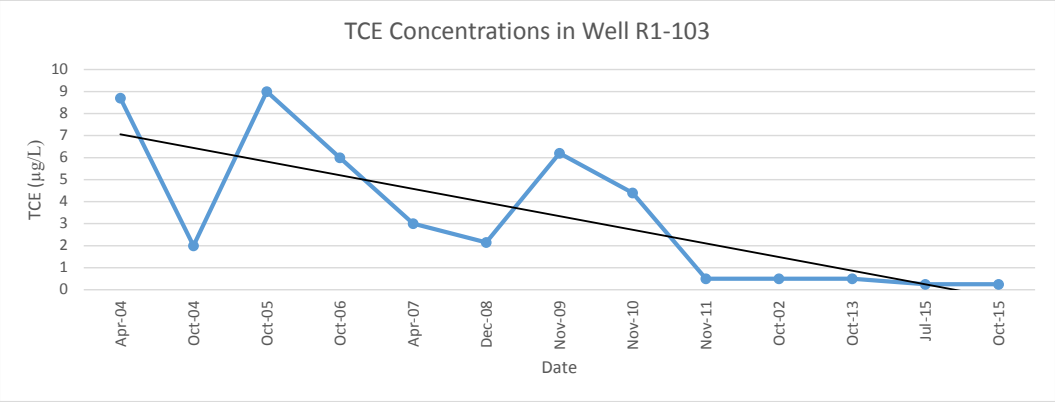
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-34
g	4
w	2
V(s)	196.6667
z	-2.353144
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	8.7
Oct-04	2
Oct-05	9
Oct-06	6
Apr-07	3
Dec-08	2.15
Nov-09	6.2
Nov-10	4.4
Nov-11	0.5
Oct-02	0.5
Oct-13	0.5
Jul-15	0.25
Oct-15	0.25

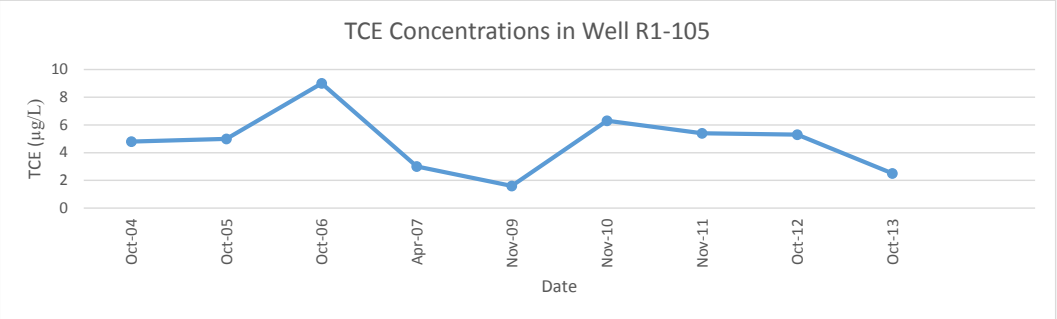
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-50
g	4
w	2
V(s)	196.6667
z	-3.494063
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z>Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Oct-04	4.8
Oct-05	5
Oct-06	9
Apr-07	3
Nov-09	1.6
Nov-10	6.3
Nov-11	5.4
Oct-12	5.3
Oct-13	2.5

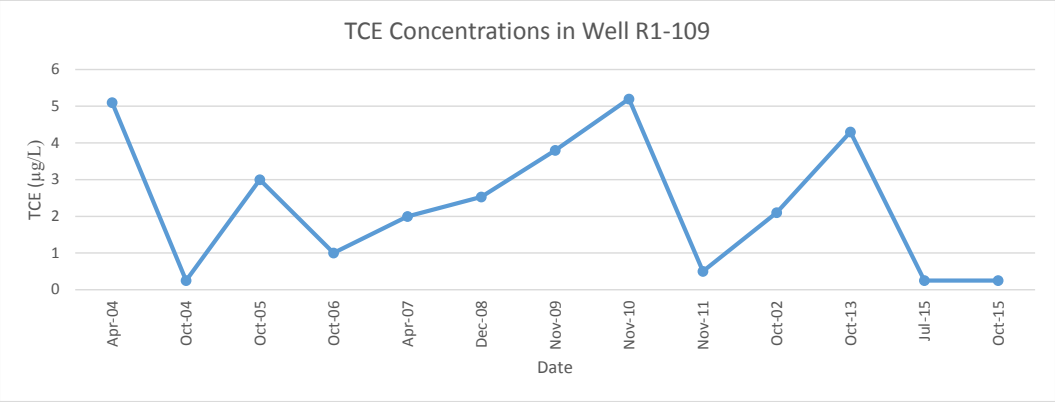
Mann-Kendall Test Using Normal Approximation for Smaller Samples (n<10)

n	9
S	-4
p	0.381
α	0.05

Ho: No trend

Ha: Downward trend

Reject Ho if p<α Ho is not rejected, there is no evidence of an downward trend at the 95% level of confidence



Date	µg/L
Apr-04	5.1
Oct-04	0.25
Oct-05	3
Oct-06	1
Apr-07	2
Dec-08	2.53
Nov-09	3.8
Nov-10	5.2
Nov-11	0.5
Oct-02	2.1
Oct-13	4.3
Jul-15	0.25
Oct-15	0.25

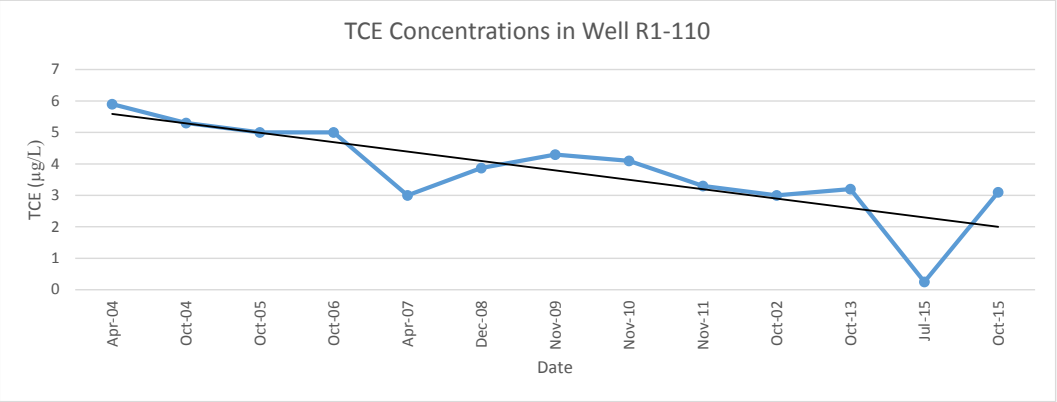
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-11
g	3
w	2
V(s)	214.6667
z	-0.682524
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	5.9
Oct-04	5.3
Oct-05	5
Oct-06	5
Apr-07	3
Dec-08	3.87
Nov-09	4.3
Nov-10	4.1
Nov-11	3.3
Oct-02	3
Oct-13	3.2
Jul-15	0.25
Oct-15	3.1

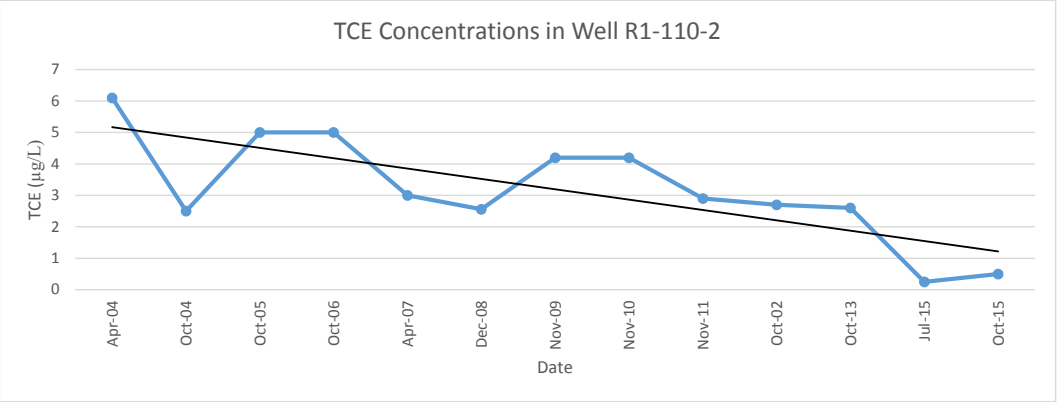
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-54
g	2
w	2
V(s)	232.6667
z	-3.474632
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	6.1
Oct-04	2.5
Oct-05	5
Oct-06	5
Apr-07	3
Dec-08	2.56
Nov-09	4.2
Nov-10	4.2
Nov-11	2.9
Oct-02	2.7
Oct-13	2.6
Jul-15	0.25
Oct-15	0.5

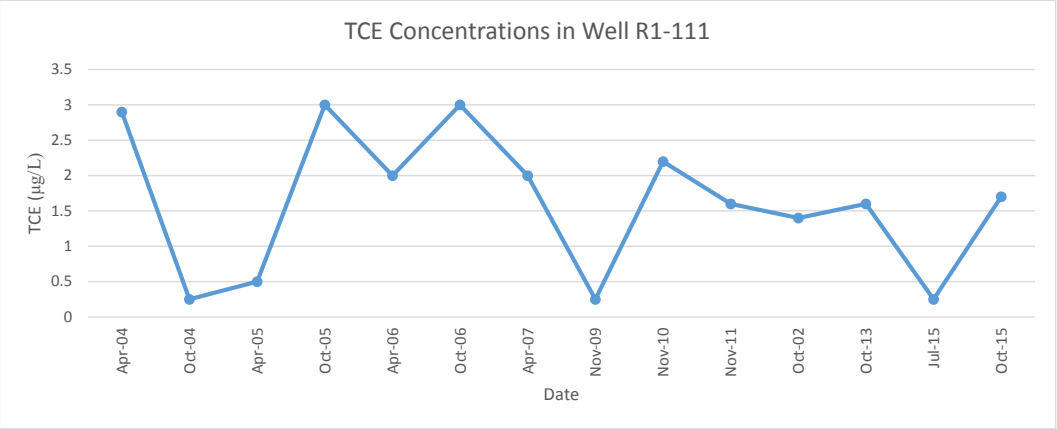
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	13
S	-42
g	2
w	2
V(s)	232.6667
z	-2.687923
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	2.9
Oct-04	0.25
Apr-05	0.5
Oct-05	3
Apr-06	2
Oct-06	3
Apr-07	2
Nov-09	0.25
Nov-10	2.2
Nov-11	1.6
Oct-02	1.4
Oct-13	1.6
Jul-15	0.25
Oct-15	1.7

Mann-Kendall Test Using Normal Approximation for Larger Samples

n	14
S	-17
g	6
w	2
V(s)	225.6667
z	-1.06509
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence

OU-5

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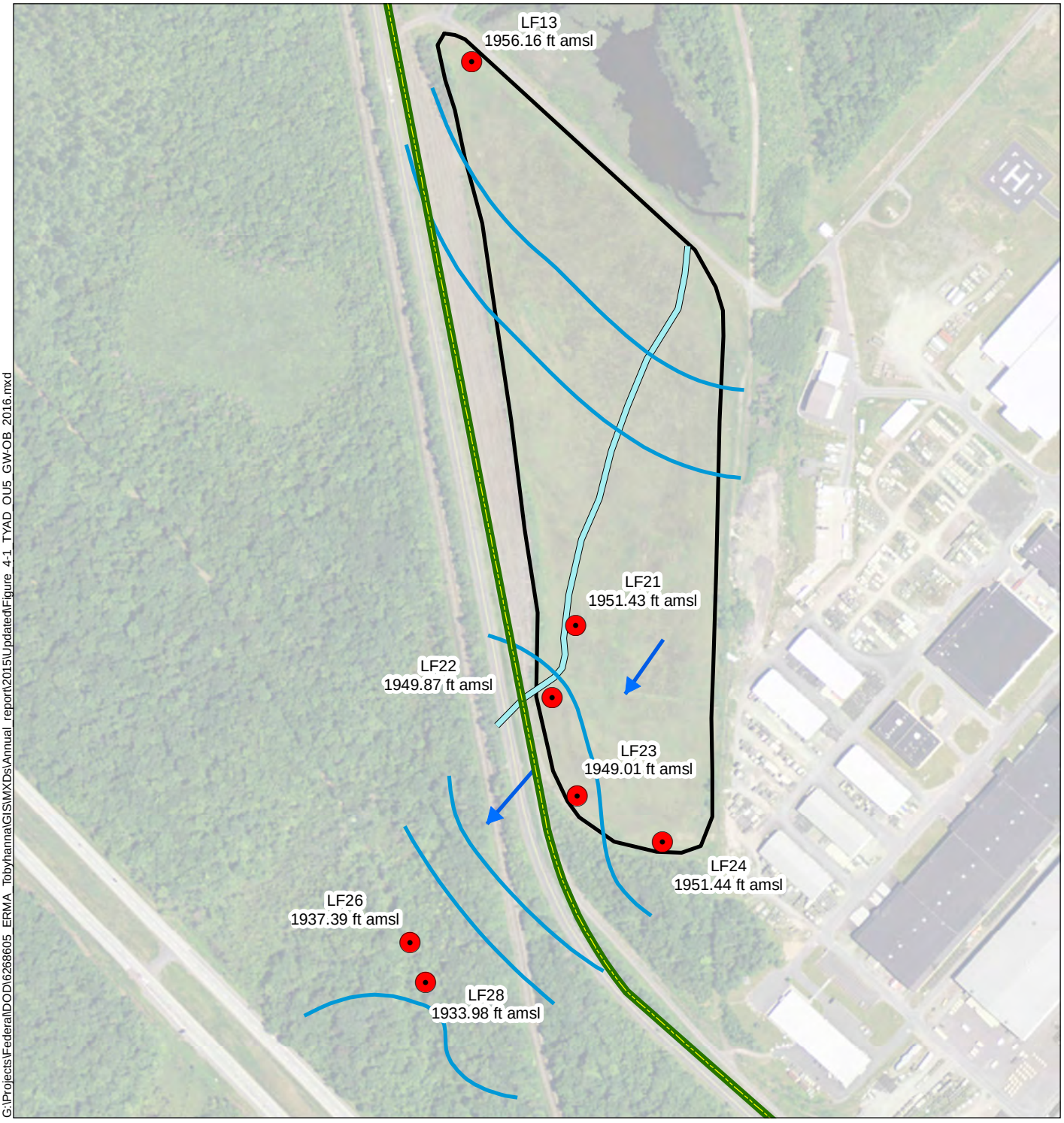

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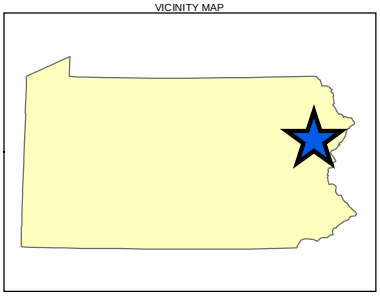
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

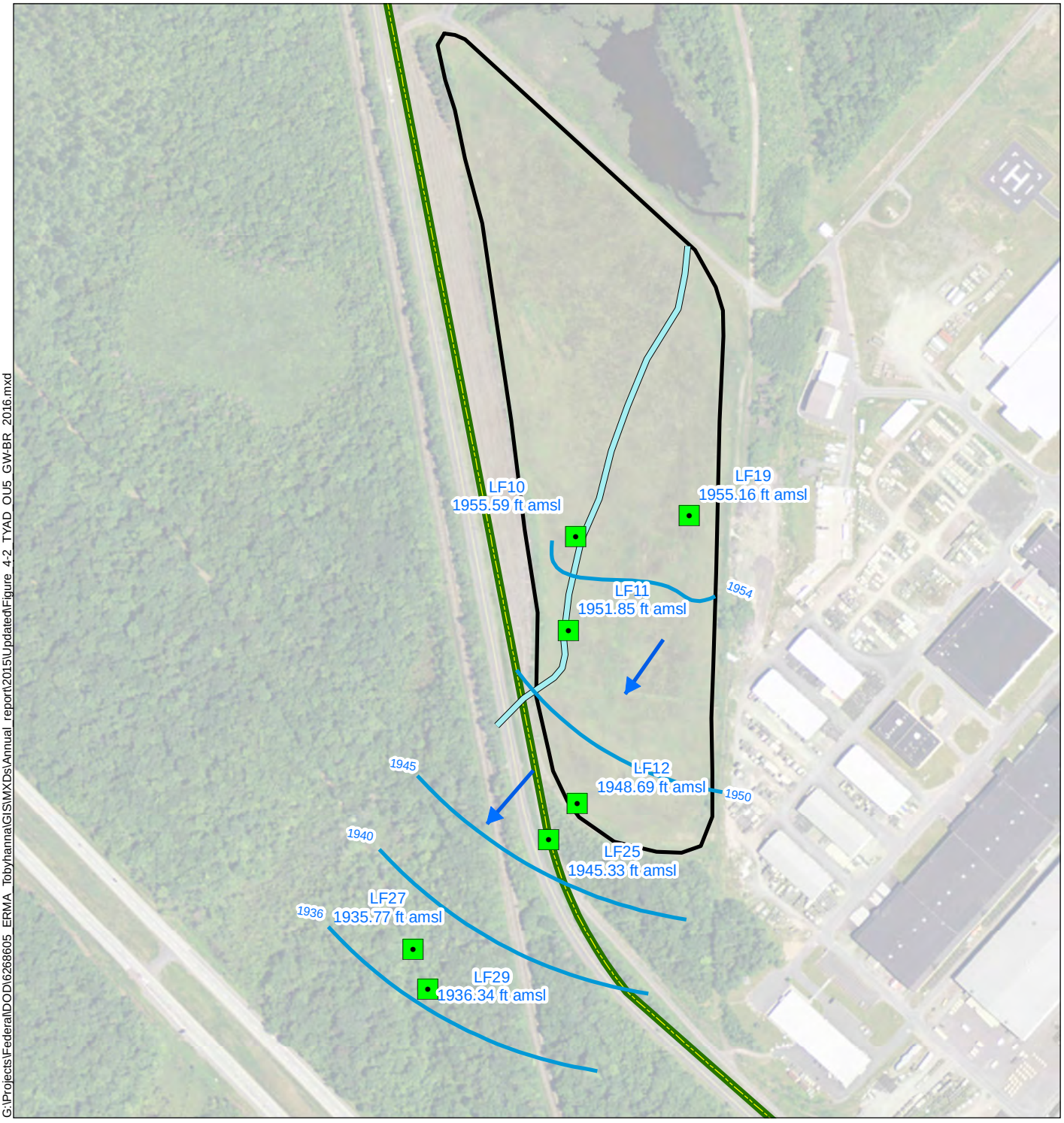
Legend

- Installation Boundary
- Tobyhanna Army Depot Location
- TBAD-001 Site Boundary
- Overburden Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-1
TBAD-001 (OU-5)
Groundwater Elevation Contours
Glacial Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



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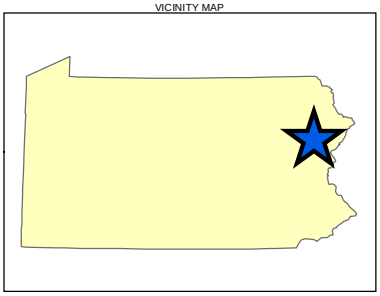
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- Bedrock Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-2
TBAD-001 (OU-5)
Groundwater Elevation Contours
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC

Table 4-3 OU-5 Groundwater Sampling Results Volatile Organic Compounds of Concern October 2015

Well ID	Aquifer	Benzene (µg/L)	Vinyl Chloride (µg/L)	1,2-dichloropropane (µg/L)	PCE (µg/L)	TCE (µg/L)
MCL	—	5	2	5	5	5
LF10	BR	0.25 U	0.25 U	0.25 U	4.60	**9.40**
LF11	BR	0.25 U	0.25 U	0.25 U	**5.30**	**15**
LF12	BR	0.25 U	0.25 U	0.25 U	2.10	**6.60**
LF13	GT	0.25 U	0.25 U	0.25 U	0.50 U	0.50 U
LF19	BR	0.25 U	0.25 U	0.25 U	2.70	**5.70**
LF21	GT	0.25 U	0.25 U	0.25 U	1.30	3.00
LF22	GT	0.85 J	0.36 J	0.25 U	0.50 U	0.50 U
LF23	GT	2.90	1.00 J	0.25 U	0.50 U	0.50 U
LF24	GT	0.25 U	0.25 U	0.25 U	0.50 U	0.50 U
LF25	BR	1.30	**5.70**	0.25 U	0.50 U	0.30 J
LF26	GT	0.43 J	0.37 J	1.40	1.10	3.50
LF27	BR	0.25 U	0.25 U	0.25 U	0.59 J	2.00
LF28	GT	0.25 U	0.25 U	0.25 U	0.29 J	0.79 J
LF29	BR	0.25 U	0.25 U	0.25 U	0.50 U	0.64 J

Notes:
µg/L = Micrograms per liter
MCL = (Safe Drinking Water Act) Maximum Contaminant Level
NS = Not Sampled for VOCs
VOC = Volatile organic compound
U = Less than the detection limit provided
J = Indicates sample results between the method detection limit (MDL) and Contract Required Detection Limit (CRDL)
BR = Bedrock aquifer
GT = Glacial till aquifer
Meets or exceeds the MCL.

Table 4-4 OU-5 Groundwater Sampling Results Selected Metals
October 2015

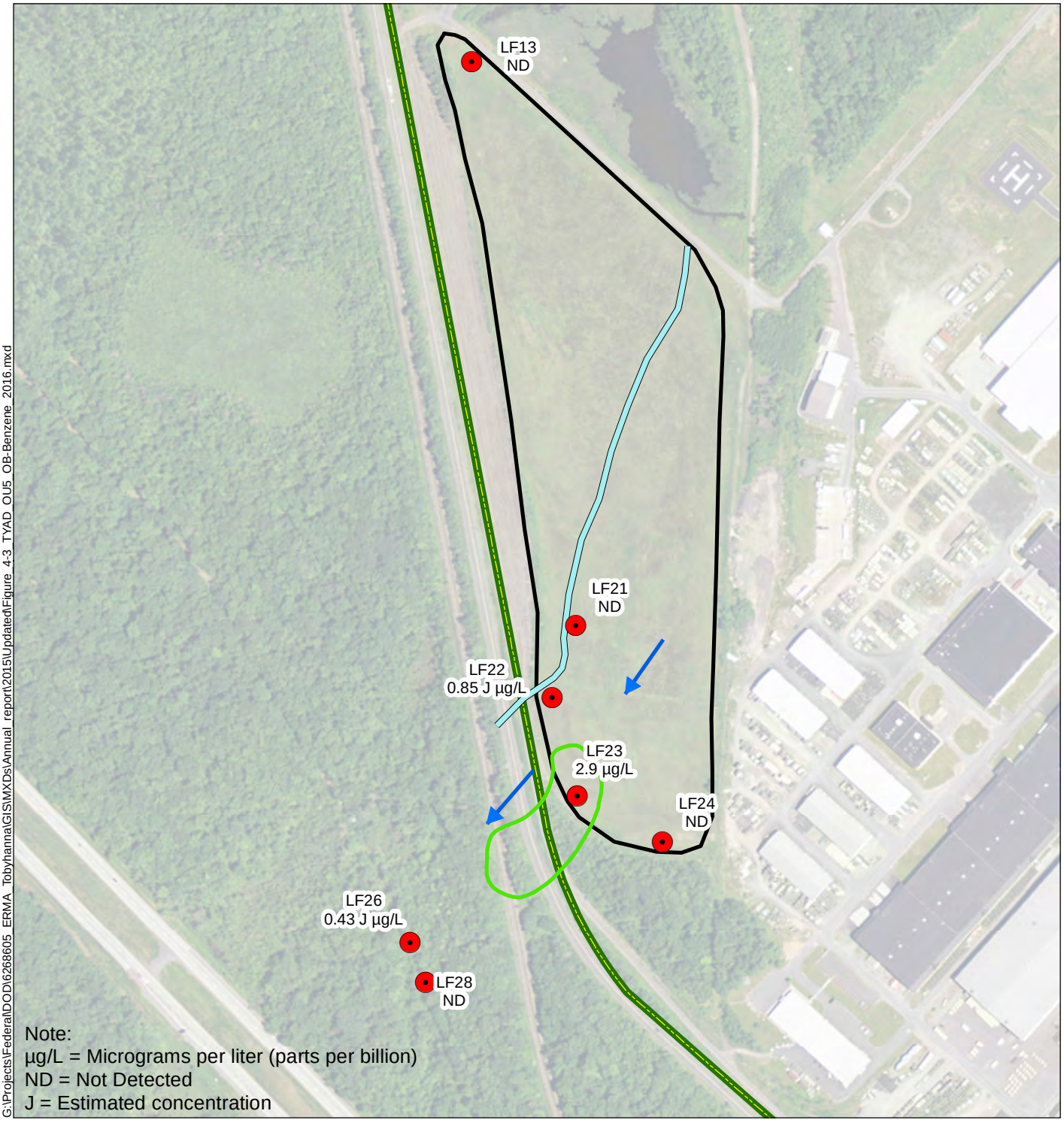
Well ID	Aquifer	Cyanide (µg/L)	Total Mercury (µg/L)	Dissolved Mercury (µg/L)	Total Arsenic (µg/L)	Dissolved Arsenic (µg/L)	Total Barium (µg/L)	Dissolved Barium (µg/L)	Total Lead (µg/L)	Dissolved Lead (µg/L)
MCL		200	2	2	10	10	2,000	2,000	15	15
LF12	BR	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF13	GT	NS	0.093 U1	0.079 J	**21 J**	**19 J**	530	500	2.6 U	2.6 U
LF22	GT	NS	0.15 U	0.15 U	**30 J**	**36 J**	680	730	1.0 J	2.6 U
LF23	GT	NS	0.15 U	0.15 U	**110**	**100**	**2200**	**2200**	0.97 J	2.6 U
LF24	GT	NS	0.35	0.27	3.5 U	3.5 U	150	130	11	11
LF26	GT	NS	0.77	0.18 J	3.5 U	3.5 U	110	99	0.78 J	0.32 U1
LF27	BR	NS	0.27	0.13 J	2.4 J	3.5 U	110	110	2.0 U1	1.1 U1
LF28	GT	NS	0.15 U	0.15 J	3.5 U	3.5 U	64	62	2.6 U1	2.6 U1
LF29	BR	NS	0.39	0.46	18.0 U	18.0 U	98	97	2.6 U	2.6 U

Notes:
µg/L = Micrograms per liter
MCL = (Safe Drinking Water) Act Maximum Contaminant Level
* = Safe Drinking Water Act
NS = Not sampled
U = Less than the detection limit provided.
J = Indicates sample results between the method detection limit (MDL) and Contract Required Detection Limit (CRDL)
B = The analyte was found in the method blank
BR = Bedrock aquifer
GT = Glacial till aquifer
Meets or exceeds the MCL.

Table 4-6 Historical OU-5 Groundwater Sampling Results for Benzene

Well ID	Apr-01 (µg/L)	Oct-01 (µg/L)	Apr-02 (µg/L)	Oct-02 (µg/L)	Apr-03 (µg/L)	Oct-03 (µg/L)	Apr-04 (µg/L)	Oct-04 (µg/L)	Apr-05 (µg/L)	Oct-05 (µg/L)	Apr-06 (µg/L)	Oct-06 (µg/L)	Apr-07 (µg/L)	Dec-08 (µg/L)	Nov-09 (µg/L)	Nov-10 (µg/L)	Nov-11 (µg/L)	Oct-12 (µg/L)	Oct-13 (µg/L)	Jul-15 (µg/L)	Oct-15 (µg/L)
MCL	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
LF10	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF11	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF12	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	0.30 J	0.50 J	0.30 J	0.10 J	1.00 U	1.00 U	0.11 J	0.35 J	0.12 J	0.43 J	0.25 U	< 0.25 U
LF16	1.00 U	1.00 U	0.76 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF19	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF20	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF21	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF22	1.00	0.57	0.71 J	0.38 J	1.40	2.80	**5.70**	2.40	**7.00**	2.00	2.00 J	2.00 J	3.00	1.15	0.99 J	1.30	4.20	1.10	2.30	0.37 J	0.85 J
LF23	**5.10**	4.90	**5.40**	**6.50**	3.30	2.90	3.70	4.40	4.00 J	**6.00 J**	**7.00 J**	**5.00 J**	3.00	**5.38**	**5.40**	**6.40**	2.60	2.80	2.70 J	2.80	2.90
LF24	1.00 U	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF25	0.50 J	0.54 J	1.60	0.85 J	0.72 J	**8.00**	1.30	1.00 U	5.00 U	1.00 U	0.60 J	0.80 J	0.30 J	0.80 J	0.70 J	1.20	0.15 J	0.37 J	0.70 J	1.10	1.30
LF26	0.68 J	0.11 J	0.90 J	1.00 U	0.60 J	0.82 J	0.87 J	1.00 U	5.00 U	1.00 U	0.70 J	1.00 J	0.30 J	0.86 J	0.96 J	1.00	0.72 J	0.69 J	1.00 U	0.35 J	0.43 J
LF27	0.37 J	1.00 U	0.33 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF28	1.00 U	0.07 J	0.15 J	1.00 U	0.13 J	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF29	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U

Notes:
µg/L = Micrograms per liter
MCL = (Safe Drinking Water Act) Maximum Contaminant Level.
NS = Not sampled
U - Less than the detection limit provided
J - Indicates sample results between the method detection limit (MDL) and Contract Required Detection Limit (CRDL).
ID = Identification
Meets or exceeds the MCL.



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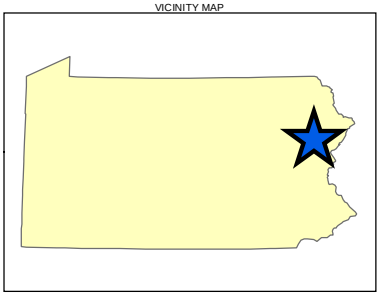
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

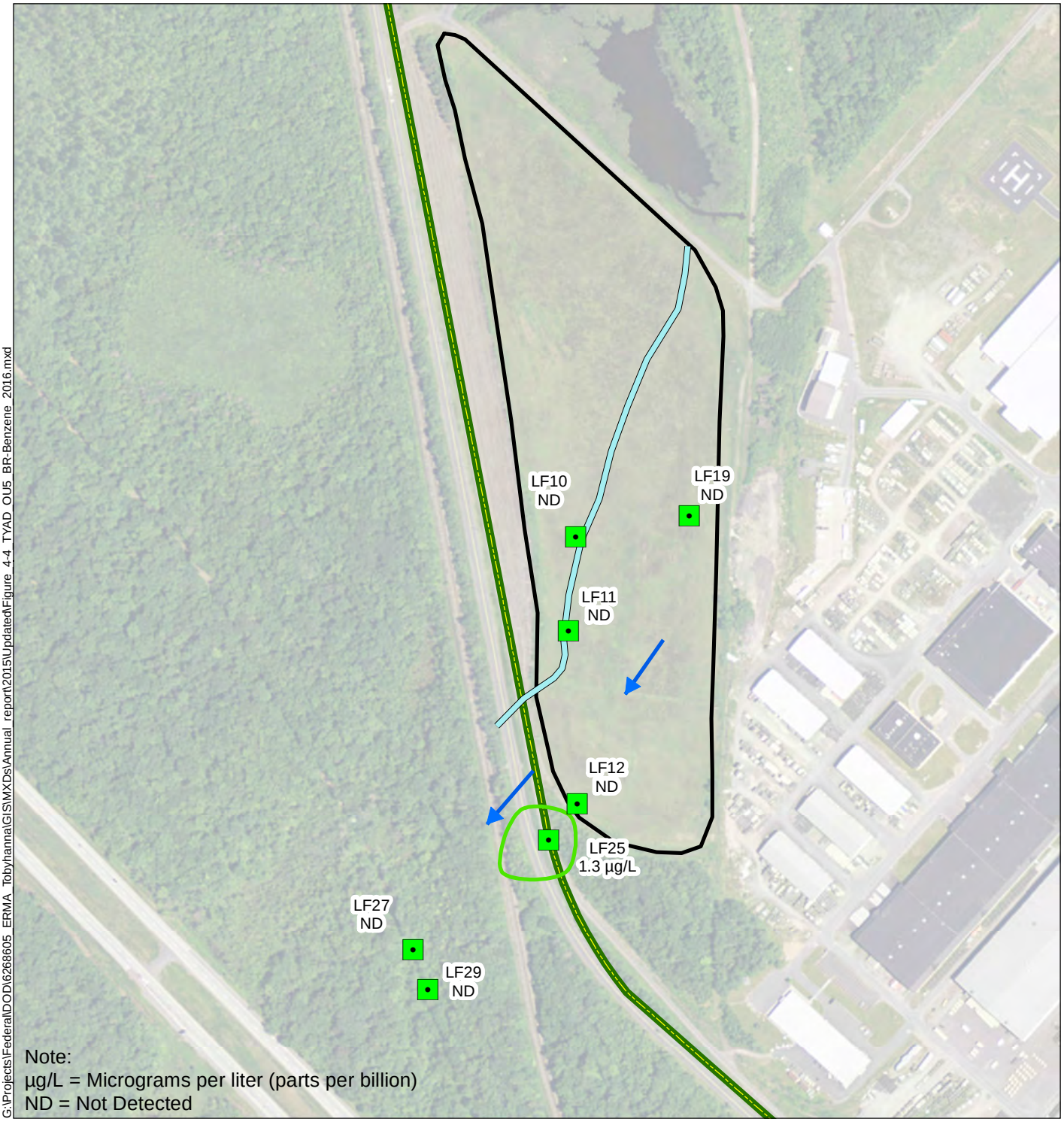
Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- Overburden Groundwater Monitoring Well
- 1 ppb Benzene Concentration Contour (Glacial Till)
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-3
TBAD-001 (OU-5)
Benzene Concentration Contour
Glacial Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

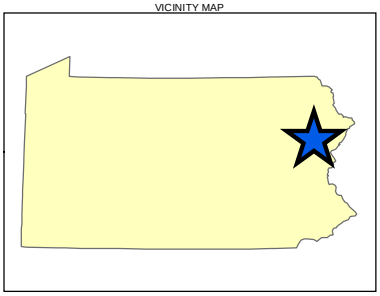
Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



G:\Projects\Federal\DOD\6268605_ERMA_Tobyhanna\GIS\MXDs\Annual report\2015\Updated\Figure_4-4_TYAD_OU5_BR-Benzene_2016.mxd

VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- Bedrock Groundwater Monitoring Well
- 1 ppb Benzene Concentration Contour (Bedrock)
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-4
TBAD-001 (OU-5)
Benzene Concentration Contour
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

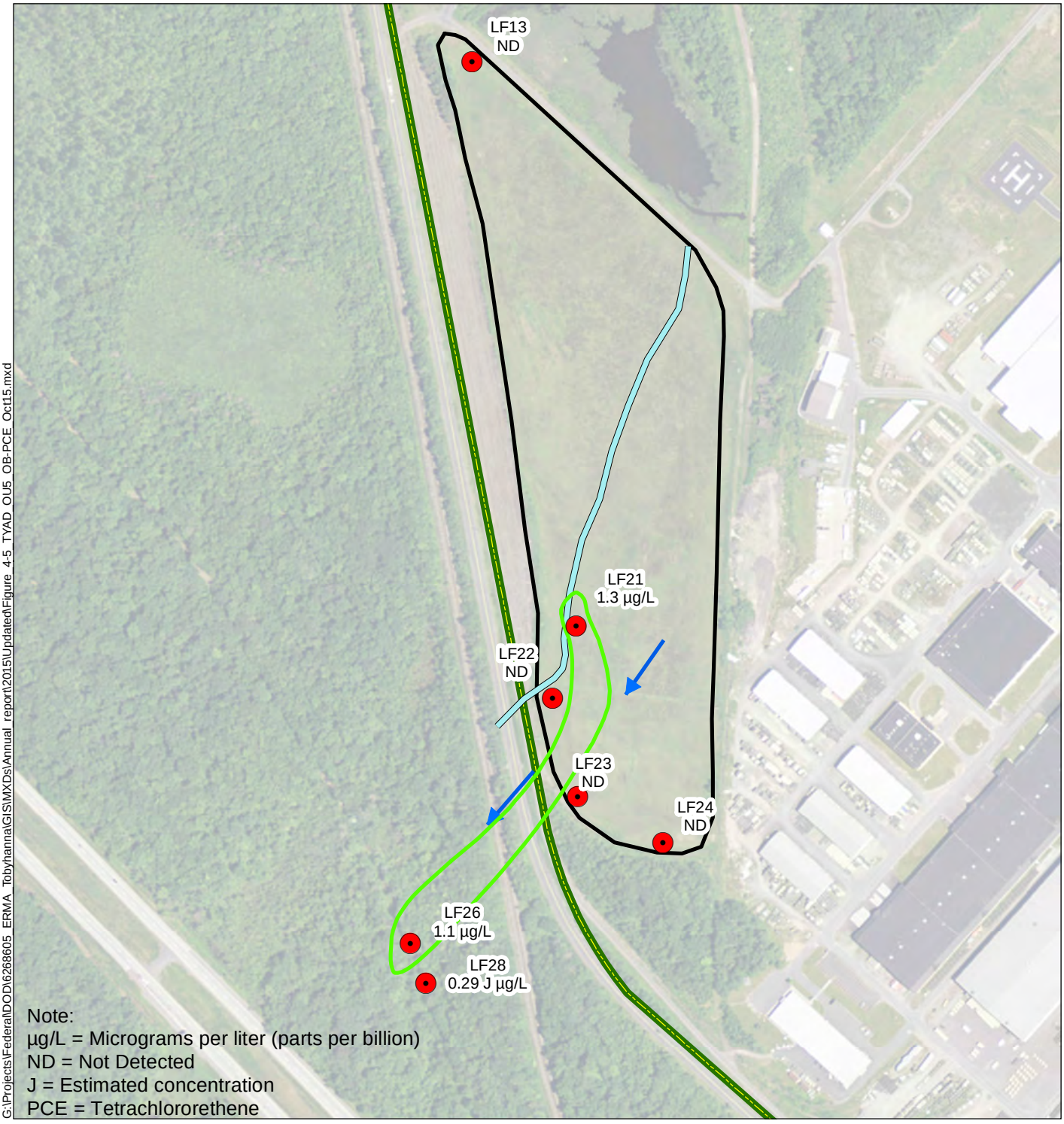
Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC

Table 4-7 Historical OU-5 Groundwater Sampling Results for PCE

Well ID	Apr-01 (mg/L)	Oct-01 (mg/L)	Apr-02 (mg/L)	Oct-02 (mg/L)	Apr-03 (mg/L)	Oct-03 (mg/L)	Apr-04 (mg/L)	Oct-04 (mg/L)	Apr-05 (mg/L)	Oct-05 (mg/L)	Apr-06 (mg/L)	Oct-06 (mg/L)	Apr-07 (mg/L)	Dec-08 (mg/L)	Nov-09 (mg/L)	Nov-10 (mg/L)	Nov-11 (mg/L)	Oct-12 (mg/L)	Oct-13 (mg/L)	Jul-15 (mg/L)	Oct-15 (mg.L)
MCL	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
LF10	0.55 J	0.42 J	0.62 J	0.42 J	0.75 J	3.30	**6.30**	**6.50**	**6.00**	**7.00**	**6.00 J**	**6.00 J**	3.00	**6.52**	**7.60**	**6.50**	**6.70**	**6.30**	**9.40**	0.46 J	4.60
LF11	4.30	4.10	**5.40**	3.10	3.50	2.60	**7.70**	**6.90**	**8.00**	**8.00**	**7.00 J**	**7.00 J**	**5.00**	**7.47**	**10.00**	**9.70**	**7.70**	**6.70**	**7.50**	2.70	**5.30**
LF12	3.10	3.60	3.00	4.80	2.60	2.90	**6.20**	**5.90**	**5.00**	**7.00**	4.00 J	4.00 J	3.00	4.47	**5.30**	**5.00**	2.50	2.70	2.10	0.50 J	2.10
LF16	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF19	2.00	2.00	1.50	1.00 U	0.86 J	**7.20**	**10.00**	3.00	**13.00**	**9.00**	**12.00 J**	**10.00 J**	**8.00**	**9.90**	**13.00**	**9.80**	**11.00**	**6.70**	**6.50**	0.29 J	2.70
LF20	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF21	2.70	3.60	4.30	4.40	3.40	3.30	3.30	3.10	3.00 J	3.00 J	2.00 J	2.00 J	2.00 J	2.50	3.50	3.00	2.40	1.60	1.40	0.66 J	1.30
LF22	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.50 U	< 0.50 U
LF23	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	0.50 U	< 0.50 U
LF24	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.50 U	< 0.50 U
LF25	0.17 J	0.14 J	0.71 J	0.15 J	1.00 U	1.00 U	1.30	1.00 U	5.00 U	0.80 J	0.40 J	0.50 J	0.10 J	0.30 J	0.31 J	0.22 J	0.20 J	1.00 U	1.00 U	0.50 U	< 0.50 U
LF26	1.40	0.84 J	1.20	0.96 J	1.50	0.91 J	0.99 J	1.20	1.00 J	0.40 J	2.00 J	0.80 J	1.00	1.00 U	0.43 J	0.27 J	0.74 J	0.21 J	0.25 J	1.20	1.10
LF27	1.60 J	0.87 J	2.20	1.10	0.99 J	1.10	2.20	1.90	1.00 J	3.00	0.90 J	1.00 J	0.70 J	1.45	2.00	1.60	1.00	0.91 J	1.20	0.60 J	0.59 J
LF28	0.45 J	0.55 J	0.72 J	0.52 J	0.64 J	0.61 J	0.80 J	0.96 J	5.00 U	0.60 J	0.60 J	0.80 J	0.40 J	0.50 J	0.76 J	0.74 J	0.56 J	0.54 J	0.45 J	0.35 J	0.29 J
LF29	0.84 J	0.67 J	1.20	0.79 J	0.79 J	0.65 J	0.99 J	1.00 U	5.00 U	1.00	0.60 J	0.60 J	0.30 J	0.50 J	0.80 J	0.69 J	0.20 J	0.37 J	0.42 J	0.32 J	< 0.50 U

Notes:
mg/L = Milligrams per liter
MCL = Safe Drinking Water Act Maximum Contaminant Level.
NS = Not sampled
U = Less than the detection limit provided.
J = Indicates sample results between the method detection limit (MDL) and Contract Required Detection Limit (CRDL).
PCE = Tetrachloroethene
ID = Identification
Meets or exceeds the MCL.



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VICINITY MAP

0 125 250 500
Feet

1 inch = 400 feet

N

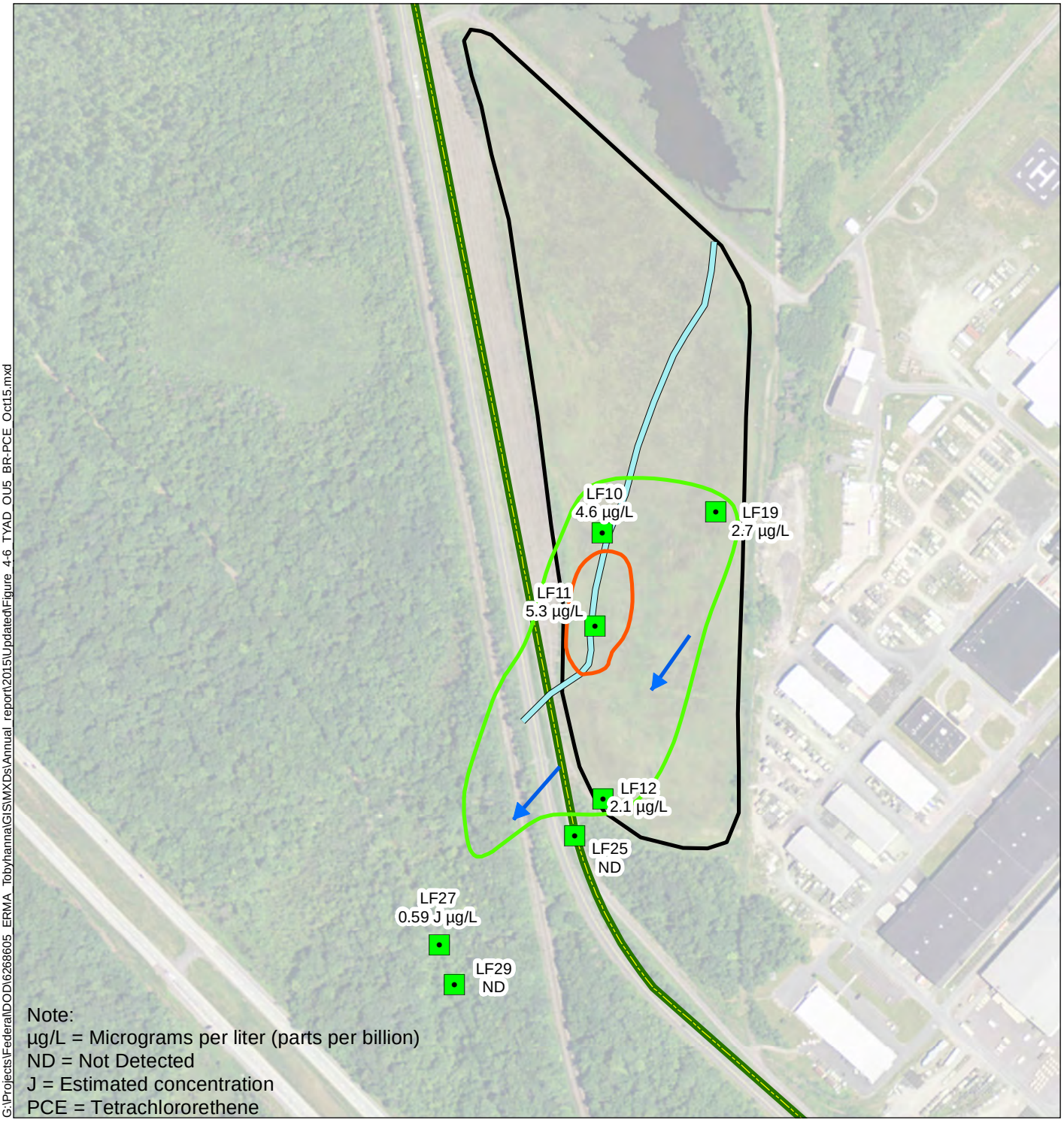
Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- 1 ppb PCE Concentration Contour (Overburden)
- Overburden Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-5
TBAD-001 (OU-5)
PCE Concentration Contour
Glacial Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

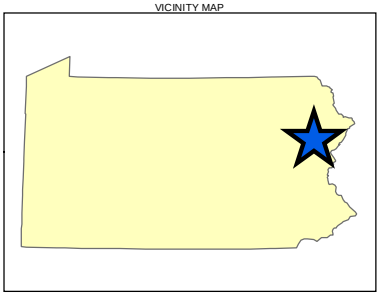
Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



G:\Projects\FederalDOD\6268605_ERMA_TobyhannaGIS\MXDs\Annual report\2015Updated\Figure_4-6_TYAD_OU5_BR-PCE_Oct15.mxd

VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- 1 ppb PCE Concentration Contour (Bedrock)
- 5 ppb PCE Concentration Contour (Bedrock)
- Bedrock Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-6
TBAD-001 (OU-5)
PCE Concentration Contour
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

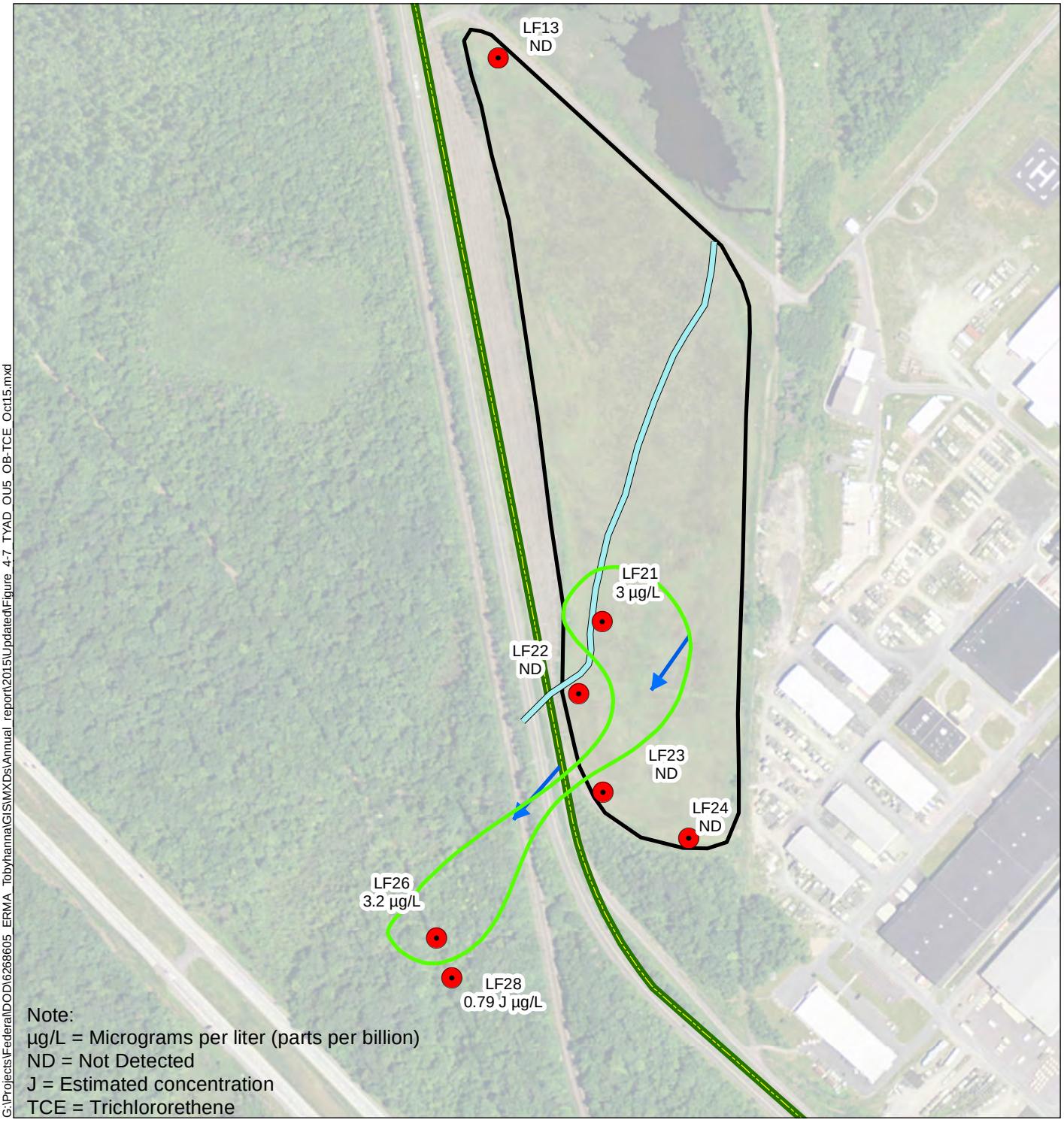
EA Engineering, Science, and Technology, Inc., PBC

Table 4-8 Historical OU-5 Groundwater Sampling Results for TCE

Well ID	Apr-01 (mg/L)	Oct-01 (mg/L)	Apr-02 (mg/L)	Oct-02 (mg/L)	Apr-03 (mg/L)	Oct-03 (mg/L)	Apr-04 (mg/L)	Oct-04 (mg/L)	Apr-05 (mg/L)	Oct-05 (mg/L)	Apr-06 (mg/L)	Oct-06 (mg/L)	Apr-07 (mg/L)	Dec-08 (mg/L)	Nov-09 (mg/L)	Nov-10 (mg/L)	Nov-11 (mg/L)	Oct-12 (mg/L)	Oct-13 (mg/L)	Jul-15 (mg/L)	Oct-15 (mg/L)
MCL	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
LF10	0.46 J	0.30 J	0.48 J	0.28 J	0.53 J	2.80	**7.30**	**8.50**	**11.00**	**11.00**	**15.00 J**	**13.00 J**	**6.00**	**14.30**	**15.00**	**11.00**	**18.00**	**14.00**	**23.00**	1.40 J	**9.4**
LF11	2.20	1.90	2.60	1.40	1.70	1.20	**5.60**	**6.30**	**10.00**	**10.00**	**12.00 J**	**14.00 J**	**10.00**	**16.50**	**20.00**	**19.00**	**18.00**	**16.00**	**19.00**	**6.8 J**	**15**
LF12	1.80	2.30	1.80	3.00	1.80	2.20	**5.30**	**4.90**	**5.00 J**	**7.0 J**	4.00 J	**6.00 J**	4.00	**8.64**	**10.00**	**11.00**	**5.80**	**6.30**	**4.50**	**0.95 J**	**6.6**
LF16	1.00 U	1.00 U	1.00 U	1.00 U	1.0 U	1.00 U	1.00 U	1.00 U	5.00 U	1.0 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF19	1.30	1.30	0.92 J	1.00 U	0.48 J	**7.60**	**16.00**	3.20	**29.00**	**18.00**	**32.00 J**	**28.00 J**	**18.00**	**23.30**	**27.00**	**19.00**	**27.00**	**17.00**	**15.00**	1.0 J	**5.7**
LF20	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF21	1.20	1.80	2.10	1.90	1.70	1.40	1.80	2.20	4.00 J	4.00 J	4.00 J	**5.00 J**	4.00 J	**5.29**	**6.60**	**6.10**	**5.80**	3.60	3.00	1.80 J	3
LF22	1.00 U	1.00 U	1.00 U	1.00 U	1.0 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.50 U	< 0.5 U
LF23	1.00 U	1.00 U	1.00 U	1.00 U	1.0 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	0.40 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	0.64 J	< 0.5 U
LF24	1.00 U	0.19 J	1.00 U	0.12 J	1.0 U	1.00 U	1.00 U	1.00 U	5.00 U	0.20 J	0.2 J	1.00 U	1.00 U	1.00 U	1.00 U	0.16 J	1.00 U	1.00 U	1.00 U	0.50 U	< 0.5 U
LF25	0.69 J	0.48 J	0.87 J	0.35 J	0.48 J	0.40 J	1.40	1.00 U	5.00 U	0.90 J	0.4 J	0.80 J	0.20 J	0.70 J	0.53 J	0.40 J	1.00 U	0.17 J	0.31 J	0.50 U	0.3 J
LF26	1.30	0.92 J	1.40	1.00	1.60	1.30	1.70	0.70	2.00 J	1.00	2.00 J	2.00 J	1.00	1.24	1.70	1.70	2.20	1.50	2.10	3.30 J	3.5
LF27	1.40	0.80 J	1.80	0.96 J	0.95 J	1.20	2.20	1.70	2.00 J	3.00	1.00 J	2.00 J	0.90 J	2.52	3.70	3.60	2.10	2.20	3.20	2.00 J	2
LF28	0.64 J	0.75 J	0.96 J	0.72 J	0.83 J	0.78 J	0.97 J	1.00 U	5.00 U	0.70 U	0.7 J	0.80 J	0.50 J	0.80 J	1.20	1.20	1.00	0.80 J	0.94 J	1.20 J	0.79 J
LF29	1.30	1.40	2.30	1.60	2.30	2.10	2.60	2.00	1.00 J	2.00	2.00 J	1.00 J	0.70 J	1.13	1.70	1.70	0.50 J	0.97 J	1.20	1.40 J	0.64 J

Notes:

mg/L = Milligrams per liter
MCL = (Safe Drinking Water Act) Maximum contaminant level
NS = Not sampled
U = Less than the detection limit provided
J = Indicates sample results between the method detection limit (MDL) and Contract Required Detection Limit (CRDL)
ID = Identification
TCE = Trichloroethene
Meets or exceeds the MCL



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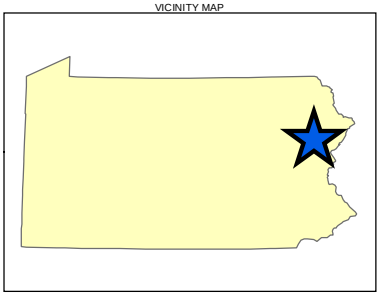
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

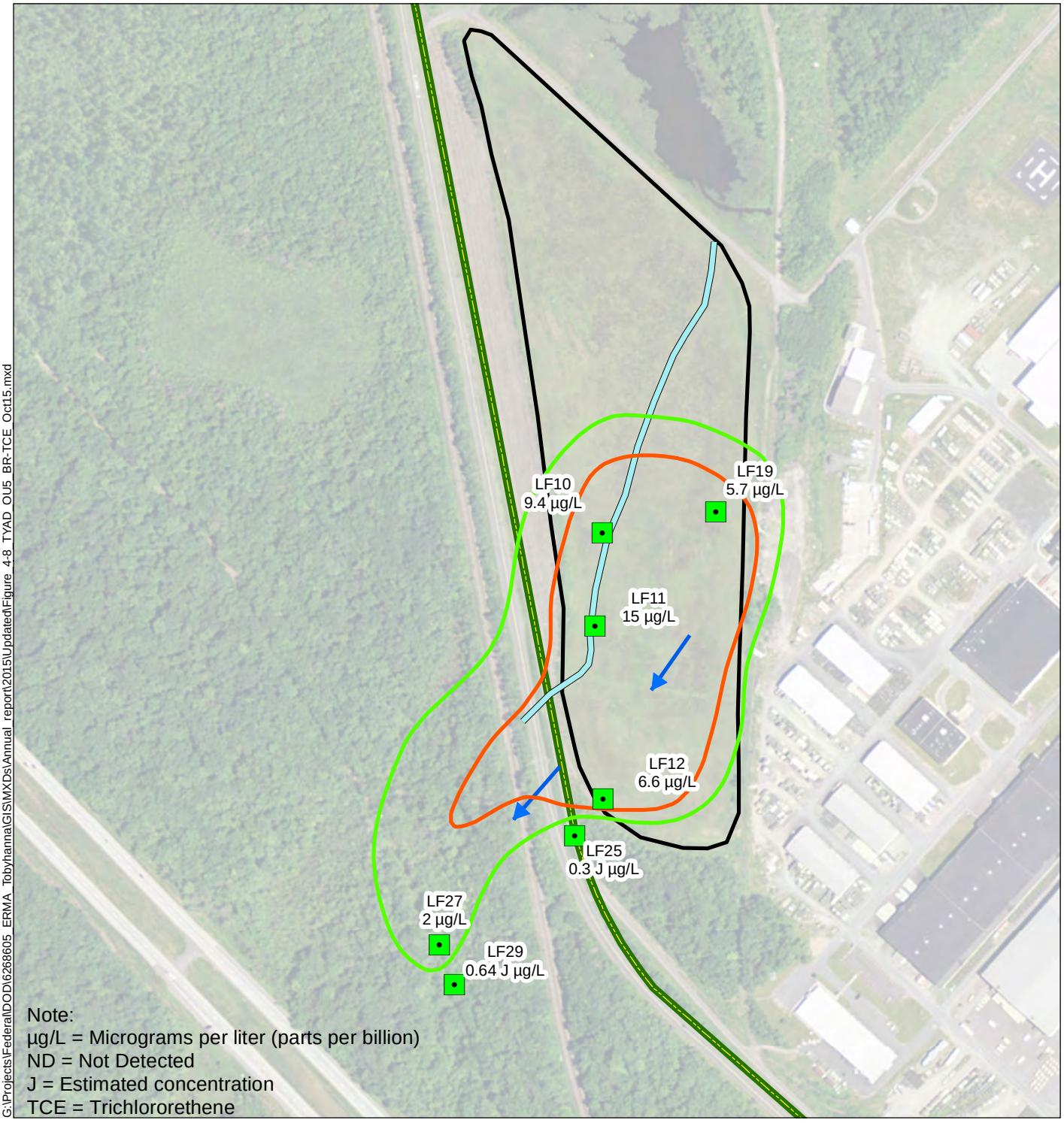
Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- 1 ppb TCE Concentration Contour (Glacial Till)
- Overburden Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-7
TBAD-001 (OU-5)
TCE Concentration Contour
Glacial Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



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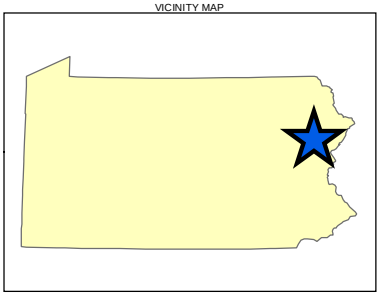
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- 1 ppb TCE Concentration Contour (Bedrock)
- 5 ppb TCE Concentration Contour (Bedrock)
- Bedrock Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-8
TBAD-001 (OU-5)
TCE Concentration Contour
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

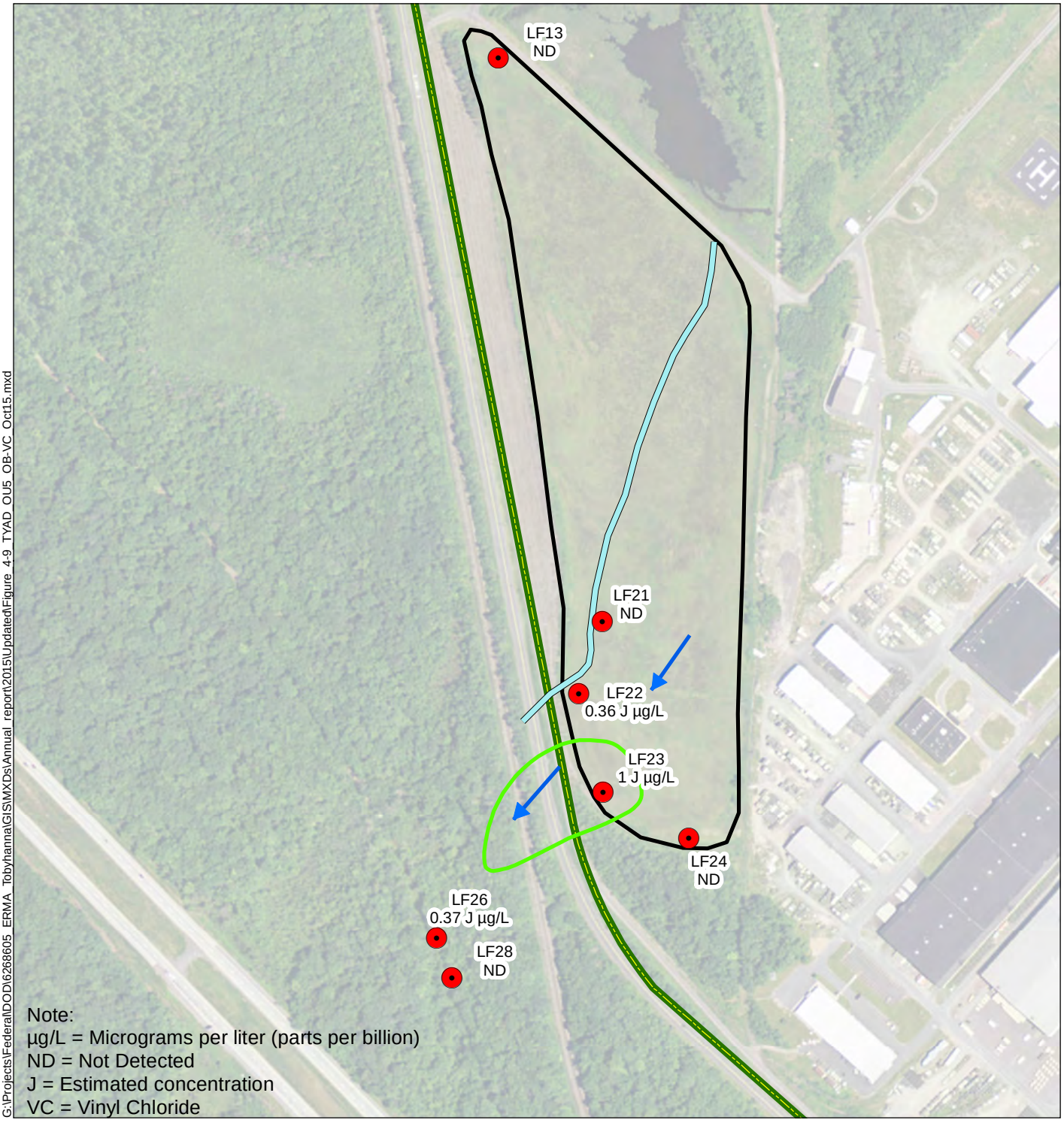
Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC

Table 4-9 Historical OU-5 Groundwater Sampling Results for Vinyl Chloride

Well ID	Apr-01 (mg/L)	Oct-01 (mg/L)	Apr-02 (mg/L)	Oct-02 (mg/L)	Apr-03 (mg/L)	Oct-03 (mg/L)	Apr-04 (mg/L)	Oct-04 (mg/L)	Apr-05 (mg/L)	Oct-05 (mg/L)	Apr-06 (mg/L)	Oct-06 (mg/L)	Apr-07 (mg/L)	Dec-08 (mg/L)	Nov-09 (mg/L)	Nov-10 (mg/L)	Nov-11 (mg/L)	Oct-12 (mg/L)	Oct-13 (mg/L)	Jul-15 (mg/L)	Oct-15 (mg/L)
MCL	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
LF10	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF11	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF12	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF16	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF19	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF20	1.00 U	1.00 U	1.00 U	1.00 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LF21	1.00 U	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF22	0.43 J	0.46 J	0.40 J	0.44 J	0.42 J	0.30 J	1.00 U	1.00 U	10.00 U	1.00 U	0.40 J	1.00 U	0.40 J	1.00 U	0.35 J	0.64 J	0.42 J	0.39 J	0.35 J	0.32 J	0.36 J
LF23	1.80	1.40	1.10	1.10	1.90	1.60	**7.90**	**21.00**	**10.00** J	**3.00**	**2.00** J	**2.00** J	**2.00**	0.69 J	1.20	1.60	1.50	1.30	1.10 J	1.50 J	1.00 J
LF24	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF25	**21.00**	**24.00**	**10.00**	**18.00**	**19.00**	**16.00**	**2.40**	**5.00**	10.00 U	**3.00**	**3.00** J	**4.00** J	1.00	**4.00**	**5.60**	**9.70**	**2.10**	**2.50**	**5.10**	**6.30**	**5.70**
LF26	1.40	0.22 J	1.30	0.33 J	1.30	0.76 J	1.00 U	1.00 U	10.00 U	1.00 U	0.60 J	0.60 J	0.40 J	1.00 U	0.29 J	0.40 J	0.33 J	1.00 U	1.00 U	0.31 J	0.37 J
LF27	0.95 J	1.00 U	0.76 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF28	0.16 J	0.21 J	0.36 J	0.26 J	0.35 J	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U
LF-29	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	< 0.25 U

Notes:
mg/L = Milligrams per liter
MCL = (Safe Drinking Water Act) Maximum contaminant level
NS = Not sampled
U = Less than the detection limit provided
J = Indicates sample results between the method detection limit (MDL) and Contract Required detection limit (CRDL)
ID = Identification
Meets or exceeds the MCL



Note:
µg/L = Micrograms per liter (parts per billion)
ND = Not Detected
J = Estimated concentration
VC = Vinyl Chloride

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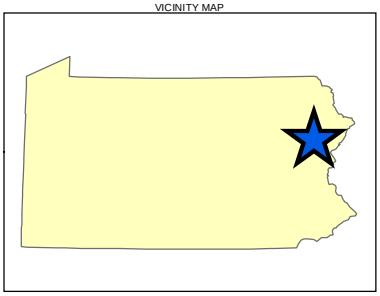
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

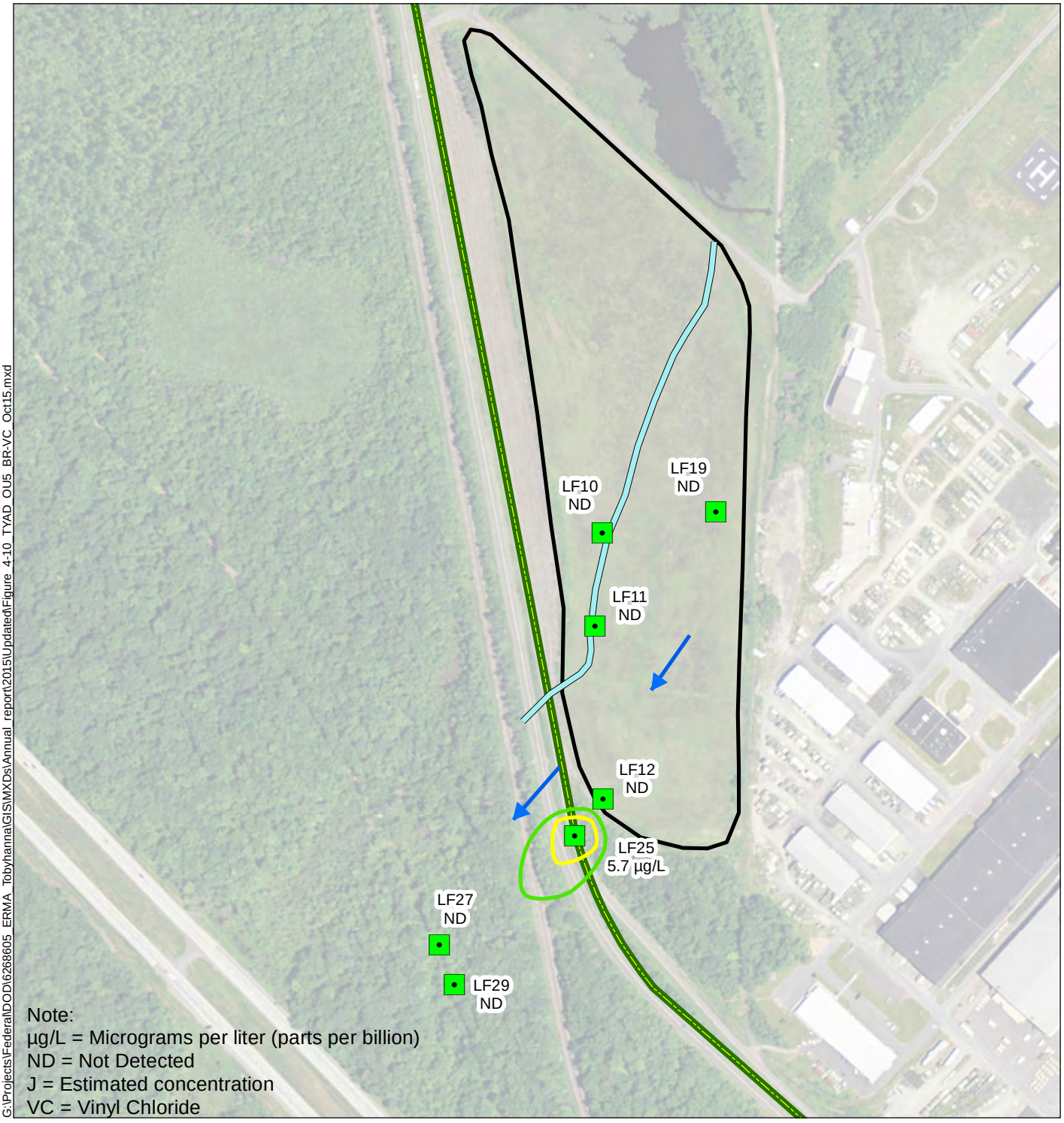
Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- 1 ppb VC Concentration Contour (Glacial Till)
- Overburden Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-9
TBAD-001 (OU-5)
Vinyl Chloride Concentration Contour
Glacial Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



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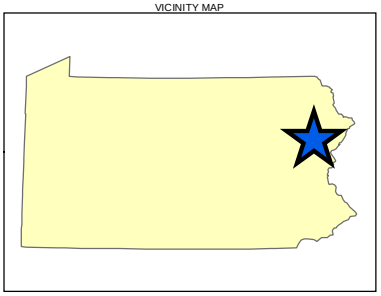
Note:
µg/L = Micrograms per liter (parts per billion)
ND = Not Detected
J = Estimated concentration
VC = Vinyl Chloride

VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

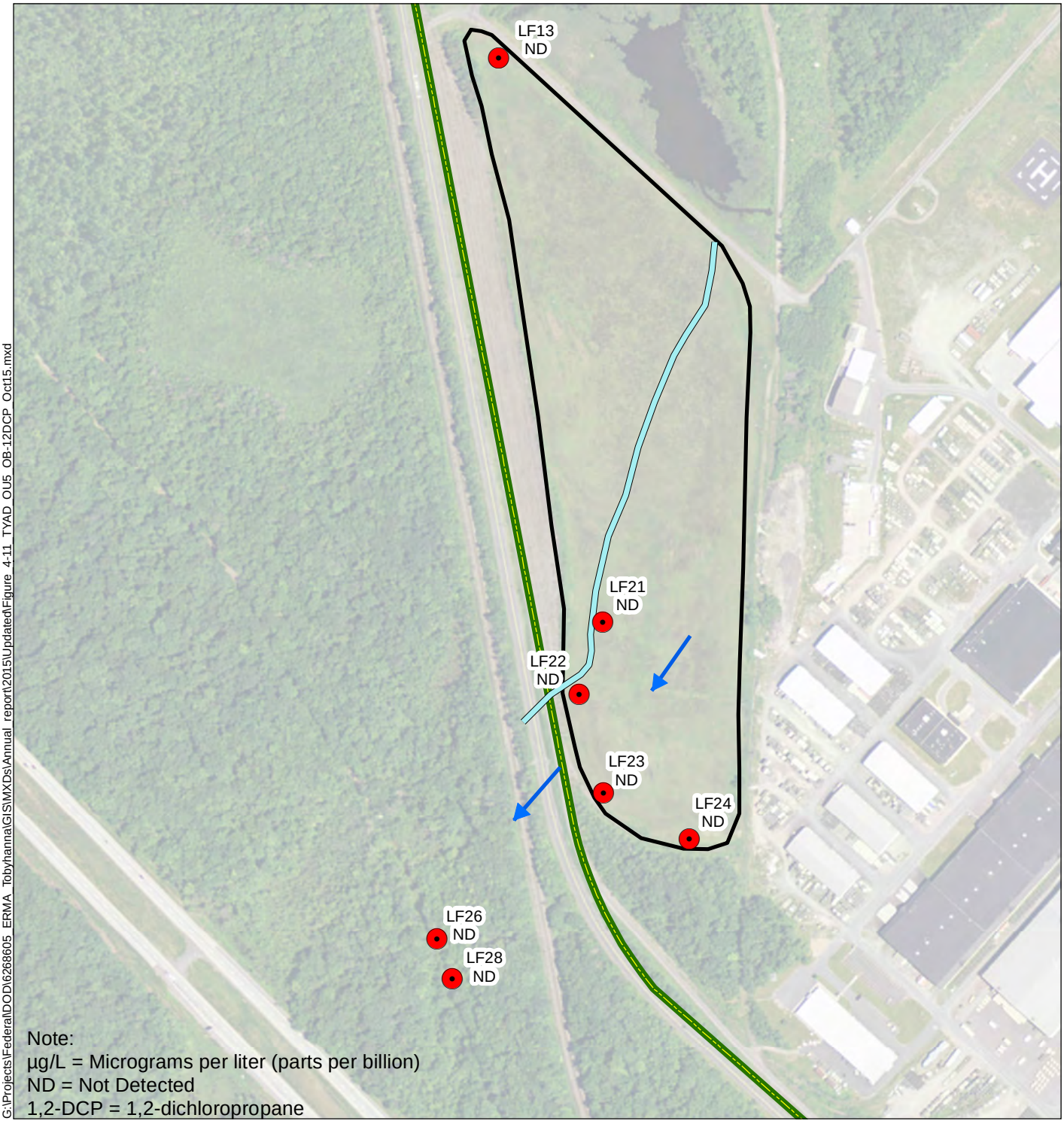
Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- 1 ppb VC Concentration Contour (Bedrock)
- 5 ppb VC Concentration Contour (Bedrock)
- Bedrock Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-10
TBAD-001 (OU-5)
VC Concentration Contour
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



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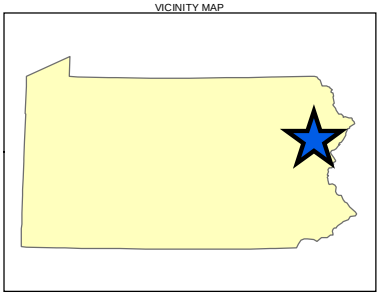
VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

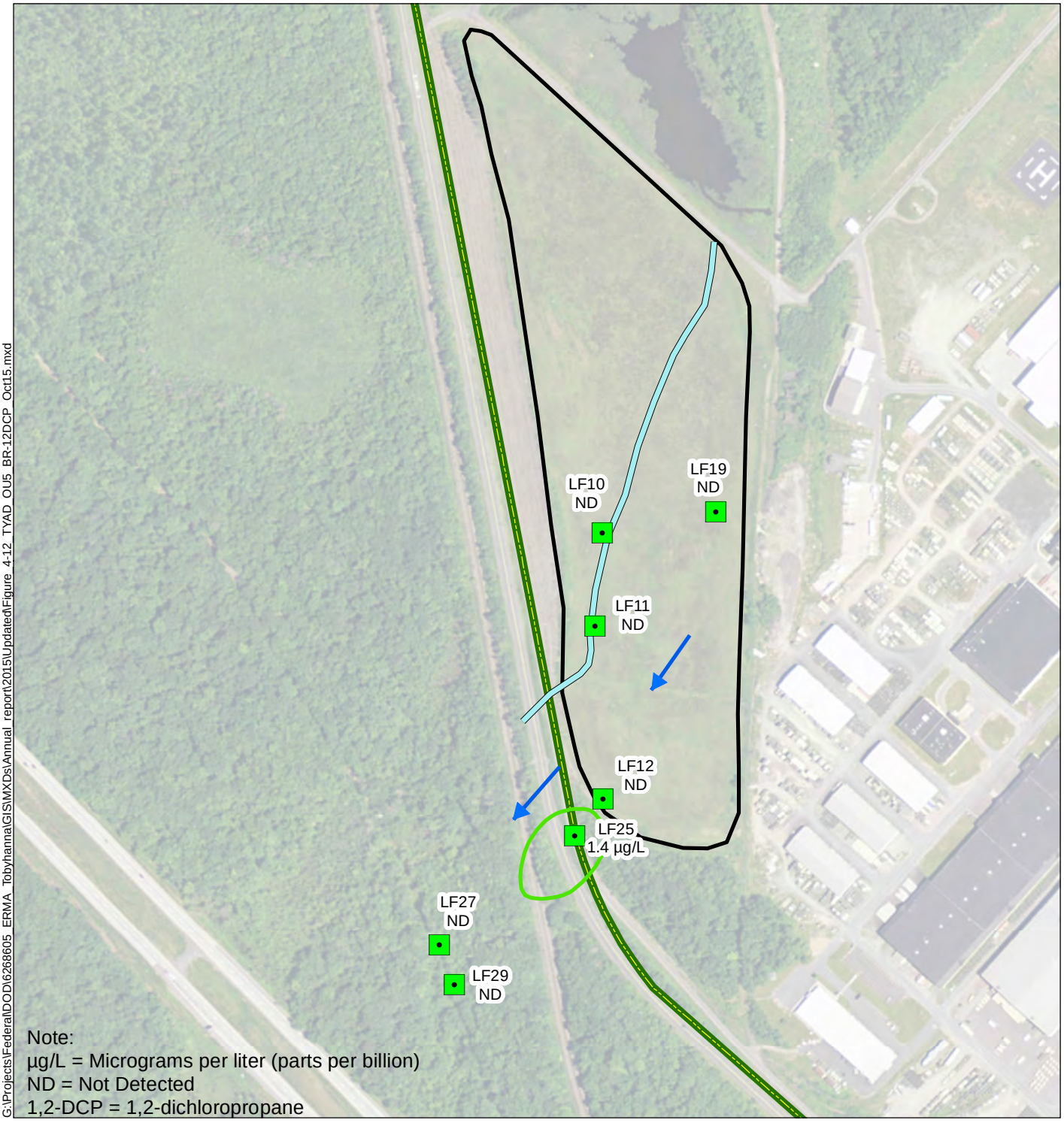
Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- Overburden Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-11
TBAD-001 (OU-5)
1,2-DCP Concentration Contour
Glacial Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

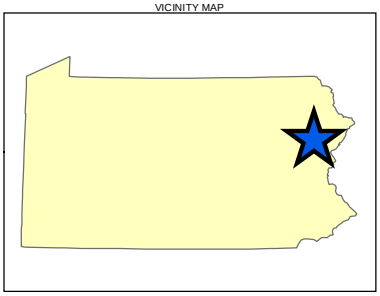
Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC



Note:
µg/L = Micrograms per liter (parts per billion)
ND = Not Detected
1,2-DCP = 1,2-dichloropropane

VICINITY MAP



0 125 250 500
Feet

1 inch = 400 feet

N

Legend

- Tobyhanna Army Depot Location
- Installation Boundary
- TBAD-001 Site Boundary
- Bedrock Groundwater Monitoring Well
- Groundwater Flow Direction
- Stormwater Drainage Pipe

Figure 4-12
TBAD-001 (OU-5)
1,2-DCP Concentration Contour
Bedrock Aquifer
Annual Performance Evaluation Report
Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Monroe County

Map Date: 5/5/2016

EA Engineering, Science, and Technology, Inc., PBC

G:\Projects\FederalDOD\6268605_ERMA_Tobyhanna\GIS\MXDs\Annual report\2015\Updated\Figure_4-12_TYAD_OU5_BR-12DCP_Oct15.mxd

Table A10-4 Historical OU-5 Monitor/Residential Well Sampling Well Program Groundwater Sampling Results for cis-1,2-DCE																						
Well ID	**Aquifer**	**Apr-01 (µg/L)**	**Oct-01 (µg/L)**	**Apr-02 (µg/L)**	**Oct-02 (µg/L)**	**Apr-03 (µg/L)**	**Oct-03 (µg/L)**	**Apr-04 (µg/L)**	**Oct-04 (µg/L)**	**Apr-05 (µg/L)**	**Oct-05 (µg/L)**	**Apr-06 (µg/L)**	**Oct-06 (µg/L)**	**Apr-07 (µg/L)**	**Dec-08 (µg/L)**	**Nov-09 (µg/L)**	**Nov-10 (µg/L)**	**Nov-11 (µg/L)**	**Oct-12 (µg/L)**	**Oct-13 (µg/L)**	**Jul-15 (µg/L)**	**Oct-15 (µg/L)**
MCL		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
LF10	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF11	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF12	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF13	GT	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	NS	1.00 U	NS	NS	NS	NS	NS	0.25 U	0.25 U
LF19	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF21	GT	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF22	GT	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF23	GT	5.10	1.90	1.30	1.40	1.00 U	2.30	5.10	**7.70**	4.00 J	**5.00**	3.00 J	2.00 J	1.00 U	1.33	0.71 J	0.78 J	0.46 J	0.40 J	5.00 U	0.25 U	0.25 U
LF24	GT	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF25	BR	0.50 J	0.55 J	1.30	0.85 J	0.68 J	0.60 J	1.00 U	1.00 U	5.00 U	0.80 J	0.40 J	0.50 J	1.00 U	0.60 J	0.67 J	1.10	0.13 J	0.23 J	0.54 J	1.20	0.25 U
LF26	GT	0.68 J	0.16 J	0.22 J	0.22 J	0.22 J	1.00 U	1.00 U	1.00 U	5.00 U	0.20 J	1.00 U	1.00 U	1.00 U	1.00 U	0.19 J	0.18 J	0.16 J	1.00 U	1.00 U	0.25 U	1.40
LF27	BR	0.37 J	1.00 U	0.2 J	0.082 J	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	0.10 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF28	GT	1.00 U	1.00 U	0.12 J	0.10 J	0.12 J	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U
LF29	BR	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.25 U	0.25 U

Notes:
µg/L = micrograms per liter
BR = Bedrock aquifer
GT = Glacial till aquifer
J = Indicates sample results between Method Detection Limit and Contract Required Detection Limit
L = Resilts biased low
MCL = (Safe Drinking Water Act) Maximum Contaminat Level
NS = Not sampled
U = Less than the detection limit provided
cis-1,2-DCE = cis-1,2-Dichloroethene
Highlight/bold equivalent to or exceeds MCL.

Table 3-5 Monitored Natural Attenuation Parameters and Groundwater Quality

	Well ID	LF-13		LF-11		LF-25		Field Duplicate*	
	Sample ID	OU-5-LF13-2015-10-20		OU-5-LF11-2015-10-20		OU-5-LF25-2015-10-20		OU-5-FD-2015-10-20	
	Date	October 20 2015		October 20 2015		October 20 2015		October 20 2015	
Analyte	Unit/Location	Upgradient		In Plume		Downgradient			
Nitrate as N	mg/L	0.0048	J	3.1	D	0.0085	J	0.0042	J
Sulfate	mg/L	0.14	J	0.57		21	D	0.13	J
Ethane	µg/L	(<2.1)	U	(<2.1)	U	(<2.1)	U	(<2.1)	U
Ethene	µg/L	(<1.9)	U	(<1.9)	U	(<1.9)	U	(<1.9)	U
Methane	mg/L	7.4	D	0.0015	J	8.5	D	7..3	D
Total Organic Carbon	mg/L	6.4		0.75	U	3.6		7.1	
Groundwater Quality Parameters									
pH		6.48		6.07		6.36			
Conductivity	Ms/cm	1.02		0.691		0.375			
Temperature	^{o}C	13.42		11.35		12.97			
ORP	mV	72		208		-3			
Turbidity	ntu	65.9		1.4		66			
Dissolved Oxygen	mg/L	0		2.56		0.02			

Note:
ID = Identification
µg/L = Micrograms per liter
cm = Centimeter
ORP = Oxidation reduction potential
Ms = Milliseconds
^{o}C = Degrees Celsius
ntu = Nephelometric turbidity unit
mV = Millivolts
J = Estimated: The analyte was positively identified; the quantitation is an estimation.
D = Diluted
U = Undetected at the Limit of Detection
*Field Duplicate was collected from groundwater monitoring well LF-13.

Table 3-6 Preliminary Screening for Anaerobic Biodegradation Processes

Analysis	Concentration in Most Contaminated Zone	Interpretation	Value	LF13 Upgradient	LF11 Center Plume	LF25 Downgradient
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	3	3	0	0
Oxygen*	>5 mg/L	Not tolerated; however, VC may be oxidized aerobically	-3			
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	2	2	0	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)- reducing conditions	3			
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	2	2	2	0
Sulfide*	>1 mg/L	Reductive pathway possible	3			
Methane*	<0.5 mg/L >0.5 mg/L	VC oxidizes Ultimate reductive daughter product, VC Accumulates	0 3	3	0	3
ORP*	<50 millivolts (mV) <-100mV	Reductive pathway possible Reductive pathway likely	1 2	0	0	1
pH*	5 < pH < 9 5 > pH >9	Optimal range for reductive pathway Outside optimal range for reductive pathway	0 -2	0	0	0
TOC	> 20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	0	0	0
Temperature*	> 20ºC	At T >20ºC biochemical process is accelerated	1	0	0	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	1			
Alkalinity	>2x background	Results from interaction between CO2 and aquifer minerals	1			
Chloride*	>2x background	Daughter product of organic chlorine	2			
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	3			
Hydrogen	<1 nM	VC oxidized	0			
Volatile Fatty Acids	> 0.1 mg/L	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2			
BTEX*	> 0.1 mg/L	Carbon and energy source; drives dechlorination	2	0	0	2
Tetrachloroethene		Material released	0	0	0	0
Trichloroethene*		Material released Daughter product of PCE	0 2	0	2	2
DCE*		Material released Daughter product of TCE If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	0 2	0	0	2
VC*		Material released Daughter product of DCE	0 2	0	0	2
1,1,1-Trichloroethane*		Material released	0	0	0	0
DCA		Daughter product of TCA under reducing conditions	2	0	0	2
Carbon Tetrachloride		Material released	0	0	0	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	2	0	0	2
Ethene/Ethane	>0.01mg/L >0.1 mg/L	Daughter product of VC/ethene	2 3	0	0	0
Chloroform		Material released Daughter product of Carbon Tetrachloride	0 2	0	0	0
Dichloromethane		Material released Daughter product of Chloroform	0 2	0	0	0
			Total	10	4	16

Notes:
DCE = Dichlorethene
VC = Vinyl chloride
DCA = Dichlorethene
mg/L = Milligrams per liter
TOC = Top of casing
pH = Presence of Hydrogen
TCE = Trichloroethene
TCA = Trichloroethane
ORP = Oxidation-reduction potential
LF = Landfill
ºC = Degrees Celsius
% = Percent
BTEX = Benzene, toluene, ethylbenzene, xylenes
mV = Millivolts
CO_2 = Carbon dioxide
NAPL = Non-aqueous phase liquid

* Required analysis.

Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

Parameter not analyzed

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OU-5 Inactive Sanitary Landfill Trend Analysis

The Mann-Kendall test, described in the EPA document: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (USEPA, March 2009) and USACE Engineer Manual: Environmental Quality – Environmental Statistics (USACE, May 2013), is an accepted method for identifying the presence of significant monotonic trends in monitoring well concentration data.

Under this method, the null hypothesis assumes that no discernible linear trend exists in concentration data over time. To test this hypothesis the Mann-Kendall statistic (test statistic) is determined. The test statistic is a function of the sample data which quantifies the probability associated with the relative magnitudes of the sample data for a given sample size (n). The significance of this probability is determined by comparison to the critical value, a threshold value of statistical significance. Under the normal approximation to the Mann-Kendall test, the critical value is determined based on a 95% level of confidence associated with the standard normal distribution. When testing for an upward trend, if the test statistic exceeds the critical value, the null hypothesis is rejected and the alternative hypothesis (upward trend) is accepted. When testing for a downward trend, if the test statistic is less than the critical value, the null hypothesis is rejected and the alternative hypothesis (downward trend) is accepted. Rejection of the null hypothesis is considered to be strong evidence of either an upward or downward trend; if the null hypothesis is not rejected there is insufficient evidence for identifying a significant, non-zero trend.

Benzene, PCE, TCE, and vinyl chloride groundwater concentrations in monitoring wells associated with OU-5 were subjected to the Mann-Kendall test to determine if any monitoring well shows a statistically significant trend in concentration. If a significant amount of data was censored (non-detects or J-qualified data), trend evaluation was not performed for that wells because the test loses statistical power when data is censored.

The Mann-Kendall test was performed for benzene concentrations at 2 monitoring wells. A downward trend was identified in 1 well and no trend was identified in the other well. The following table presents the results of the benzene concentration trend evaluation.

Benzene Trends in OU-5 Monitoring Wells

Well	Aquifer	Test Statistic	Critical Value	Trend
LF22	Glacial till	-1.962	-1.64	Downward
LF23	Glacial till	-0.060	-1.64	No trend

The Mann-Kendall test was performed for PCE concentrations at 5 monitoring wells. A downward trend was identified in 1 well and no trend was identified for the other 4 wells. The following table presents the results of the PCE concentration trend evaluation.

PCE Trends in OU-5 Monitoring Wells

Well	Aquifer	Test Statistic	Critical Value	Trend
LF10	Bedrock	0.392	1.64	No trend
LF11	Bedrock	-0.478	-1.64	No trend
LF12	Bedrock	-2.522	-1.64	Downward
LF19	Bedrock	-1.091	-1.64	No trend
LF21	Glacial till	-0.765	-1.64	No trend

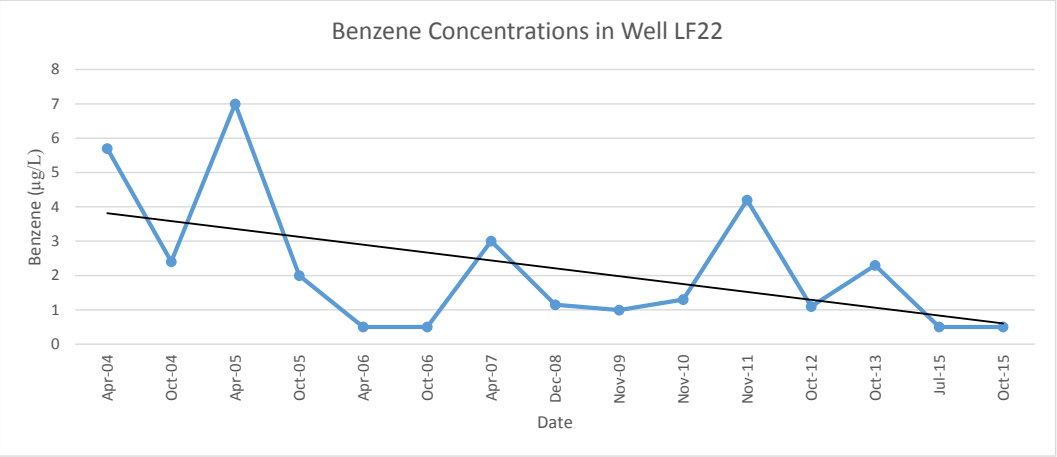
The Mann-Kendall test was performed for TCE concentrations at 6 monitoring wells. An upward trend was identified in 2 wells and no trend was identified for 4 well. The following table presents the results of the TCE concentration trend evaluation.

TCE Trends in OU-5 Monitoring Wells				
Well	**Aquifer**	**Test Statistic**	**Critical Value**	**Trend**
LF10	Bedrock	1.616	1.64	No trend
LF11	Bedrock	1.964	1.64	Upward
LF12	Bedrock	1.588	1.64	No trend
LF19	Bedrock	-0.392	-1.64	No trend
LF26	Glacial till	2.230	1.64	Upward
LF27	Bedrock	0.758	1.64	No trend

Due to the upward trend identified at LF11 where TCE concentrations have consistently exceeded the cleanup goal, the TCE concentration trend at LF11 was also analyzed for 2009 to present using a small-sample Mann-Kendall test. A downward trend was identified with a test statistic of 0.015 and an alpha value of 0.05.

The Mann-Kendall test was performed for vinyl chloride concentrations at 2 monitoring wells. A downward trend was identified in 1 well and an upward trend was identified for 1 well. The following table presents the results of the vinyl chloride concentration trend evaluation.

Vinyl Chloride Trends in OU-5 Monitoring Wells				
Well	**Aquifer**	**Test Statistic**	**Critical Value**	**Trend**
LF23	Glacial till	-4.336	-1.64	Downward
LF25	Bedrock	2.379	1.64	Upward



Date	µg/L
Apr-04	5.7
Oct-04	2.4
Apr-05	7
Oct-05	2
Apr-06	0.5
Oct-06	0.5
Apr-07	3
Dec-08	1.15
Nov-09	0.99
Nov-10	1.3
Nov-11	4.2
Oct-12	1.1
Oct-13	2.3
Jul-15	0.5
Oct-15	0.5

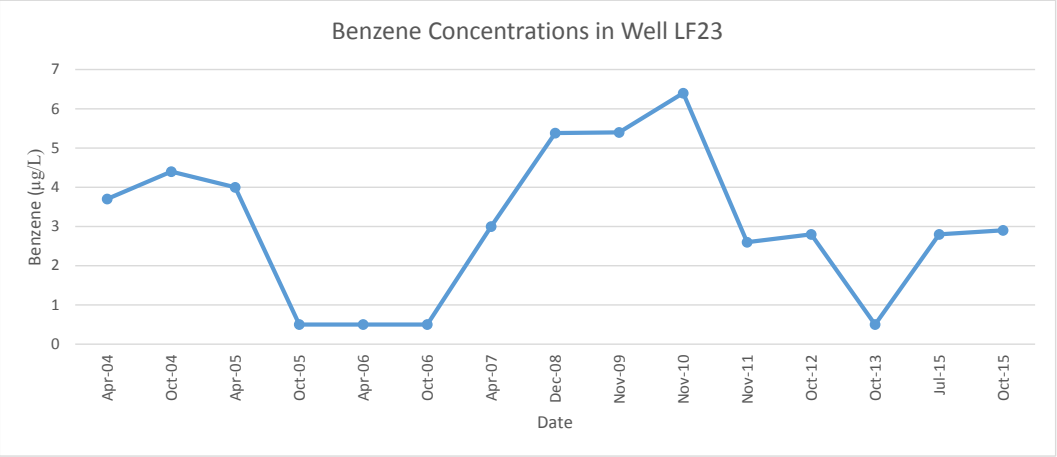
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-35
g	6
w	2
V(s)	300.3333
z	-1.961901
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	3.7
Oct-04	4.4
Apr-05	4
Oct-05	0.5
Apr-06	0.5
Oct-06	0.5
Apr-07	3
Dec-08	5.38
Nov-09	5.4
Nov-10	6.4
Nov-11	2.6
Oct-12	2.8
Oct-13	0.5
Jul-15	2.8
Oct-15	2.9

Mann-Kendall Test Using Normal Approximation for Larger Samples

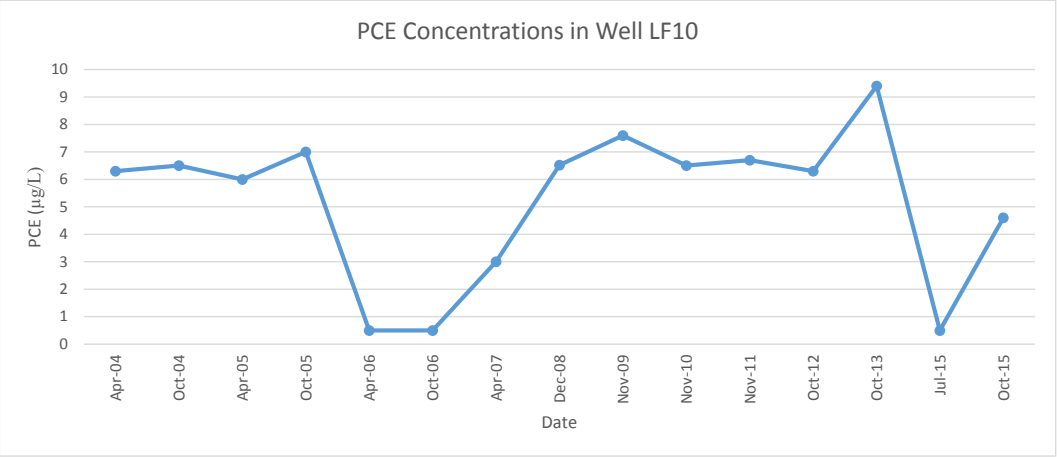
n	15
S	-2
g	7
w	2
V(s)	282.3333
z	-0.059514
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	6.3
Oct-04	6.5
Apr-05	6
Oct-05	7
Apr-06	0.5
Oct-06	0.5
Apr-07	3
Dec-08	6.52
Nov-09	7.6
Nov-10	6.5
Nov-11	6.7
Oct-12	6.3
Oct-13	9.4
Jul-15	0.5
Oct-15	4.6

Mann-Kendall Test Using Normal Approximation for Larger Samples

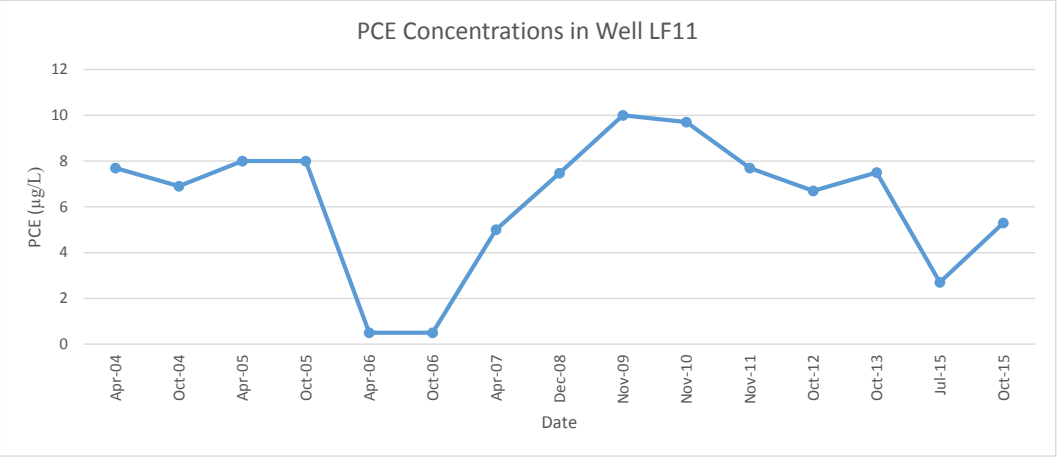
n	15
S	6
g	5
w	2
V(s)	318.3333
z	0.392335
Z(0.95)	1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z>Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	7.7
Oct-04	6.9
Apr-05	8
Oct-05	8
Apr-06	0.5
Oct-06	0.5
Apr-07	5
Dec-08	7.47
Nov-09	10
Nov-10	9.7
Nov-11	7.7
Oct-12	6.7
Oct-13	7.5
Jul-15	2.7
Oct-15	5.3

Mann-Kendall Test Using Normal Approximation for Larger Samples

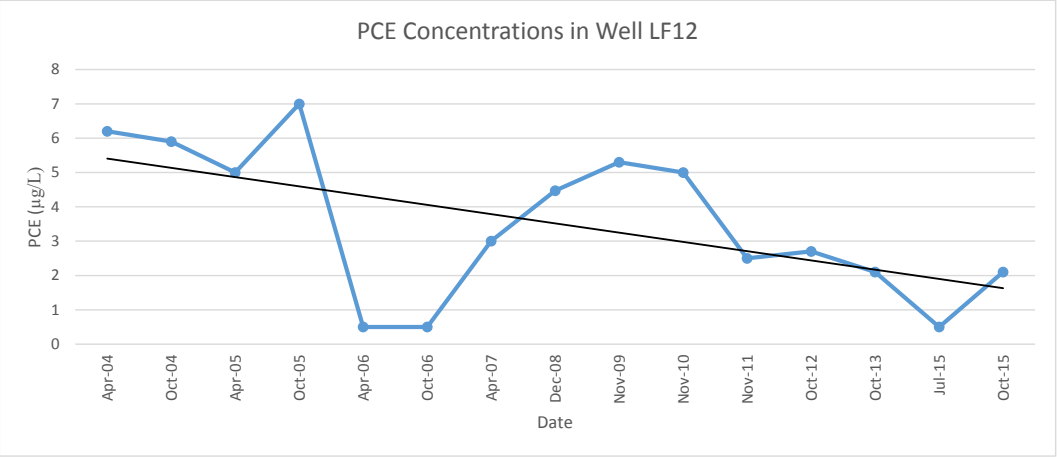
n	15
S	-10
g	3
w	2
V(s)	354.3333
z	-0.47812
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of an downward trend at the 95% level of confidence



Date	µg/L
Apr-04	6.2
Oct-04	5.9
Apr-05	5
Oct-05	7
Apr-06	0.5
Oct-06	0.5
Apr-07	3
Dec-08	4.47
Nov-09	5.3
Nov-10	5
Nov-11	2.5
Oct-12	2.7
Oct-13	2.1
Jul-15	0.5
Oct-15	2.1

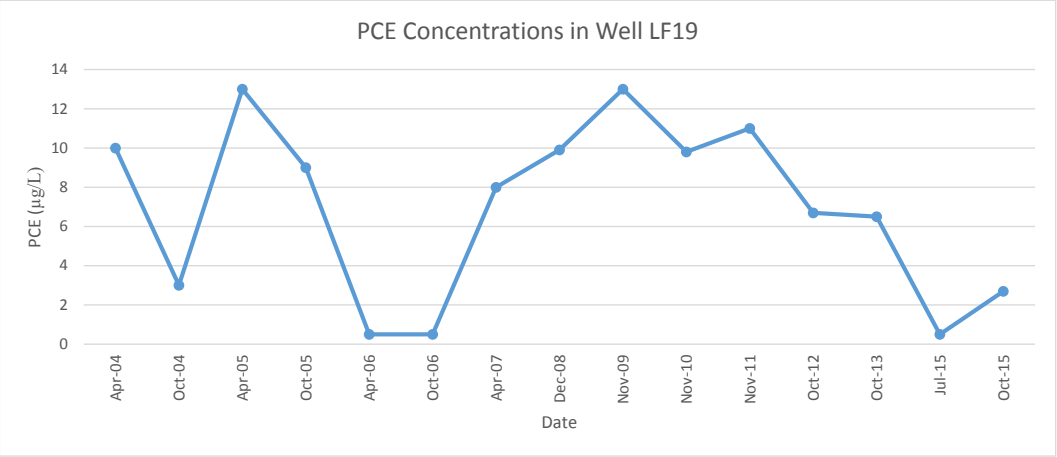
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-46
g	5
w	2
V(s)	318.3333
z	-2.522153
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	10
Oct-04	3
Apr-05	13
Oct-05	9
Apr-06	0.5
Oct-06	0.5
Apr-07	8
Dec-08	9.9
Nov-09	13
Nov-10	9.8
Nov-11	11
Oct-12	6.7
Oct-13	6.5
Jul-15	0.5
Oct-15	2.7

Mann-Kendall Test Using Normal Approximation for Larger Samples

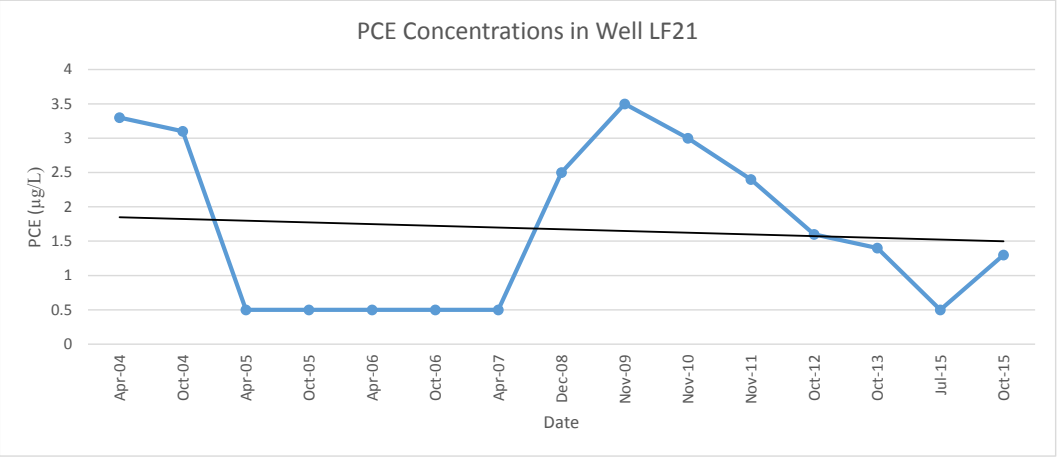
n	15
S	-21
g	4
w	2
V(s)	336.3333
z	-1.090549
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	3.3
Oct-04	3.1
Apr-05	0.5
Oct-05	0.5
Apr-06	0.5
Oct-06	0.5
Apr-07	0.5
Dec-08	2.5
Nov-09	3.5
Nov-10	3
Nov-11	2.4
Oct-12	1.6
Oct-13	1.4
Jul-15	0.5
Oct-15	1.3

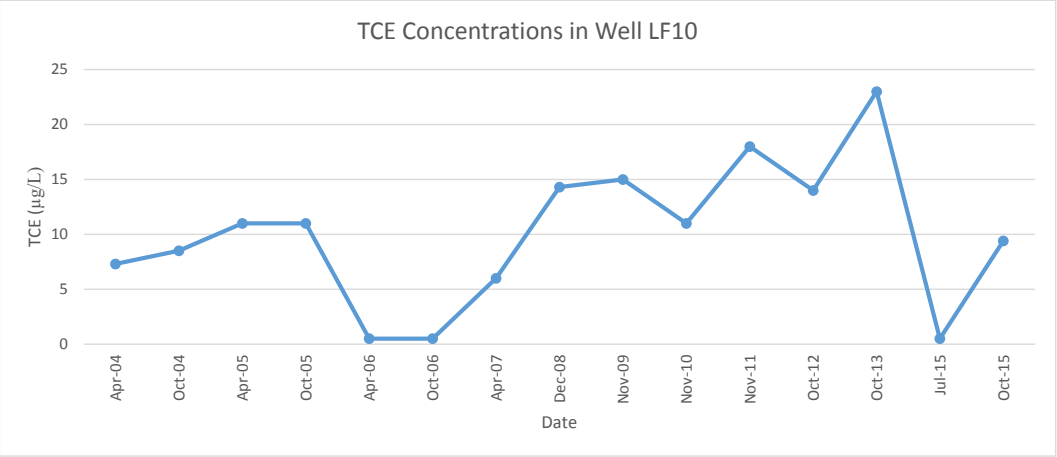
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-10
g	15
w	2
V(s)	138.3333
z	-0.765207
Z(0.95)	-1.64

Ho: No trend

Ha: downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of an downward trend at the 95% level of confidence



Date	µg/L
Apr-04	7.3
Oct-04	8.5
Apr-05	11
Oct-05	11
Apr-06	0.5
Oct-06	0.5
Apr-07	6
Dec-08	14.3
Nov-09	15
Nov-10	11
Nov-11	18
Oct-12	14
Oct-13	23
Jul-15	0.5
Oct-15	9.4

Mann-Kendall Test Using Normal Approximation for Larger Samples

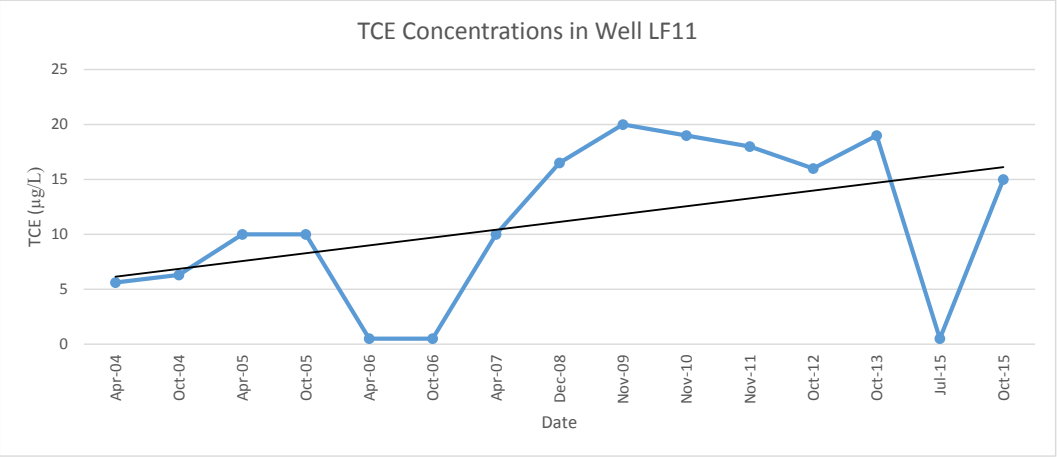
n	15
S	27
g	6
w	2
V(s)	300.3333
z	1.615683
Z(0.95)	1.64

Ho: No trend

Ha: upward trend

Reject Ho if z>Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	5.6
Oct-04	6.3
Apr-05	10
Oct-05	10
Apr-06	0.5
Oct-06	0.5
Apr-07	10
Dec-08	16.5
Nov-09	20
Nov-10	19
Nov-11	18
Oct-12	16
Oct-13	19
Jul-15	0.5
Oct-15	15

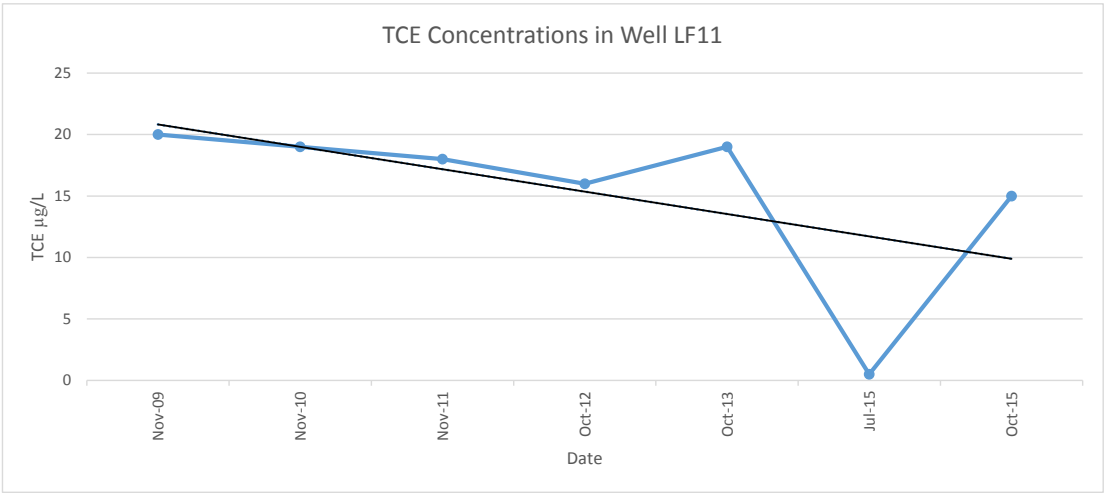
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	32
g	7
w	2
V(s)	282.3333
z	1.963961
Z(0.95)	1.64

Ho: No trend

Ha: upward trend

Reject Ho if z>Z(0.95) Ho is rejected, there is evidence of an upward trend at the 95% level of confidence



Date	µg/L
Nov-09	20
Nov-10	19
Nov-11	18
Oct-12	16
Oct-13	19
Jul-15	0.5
Oct-15	15

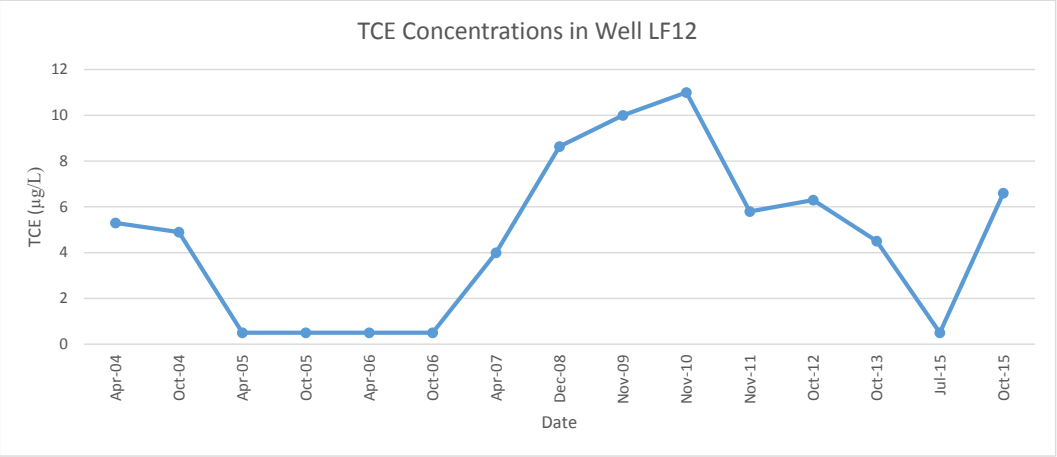
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	7
S	-14
p	0.015
α	0.05

Ho: No trend

Ha: Downward trend

Reject Ho if p<α Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	5.3
Oct-04	4.9
Apr-05	0.5
Oct-05	0.5
Apr-06	0.5
Oct-06	0.5
Apr-07	4
Dec-08	8.64
Nov-09	10
Nov-10	11
Nov-11	5.8
Oct-12	6.3
Oct-13	4.5
Jul-15	0.5
Oct-15	6.6

Mann-Kendall Test Using Normal Approximation for Larger Samples

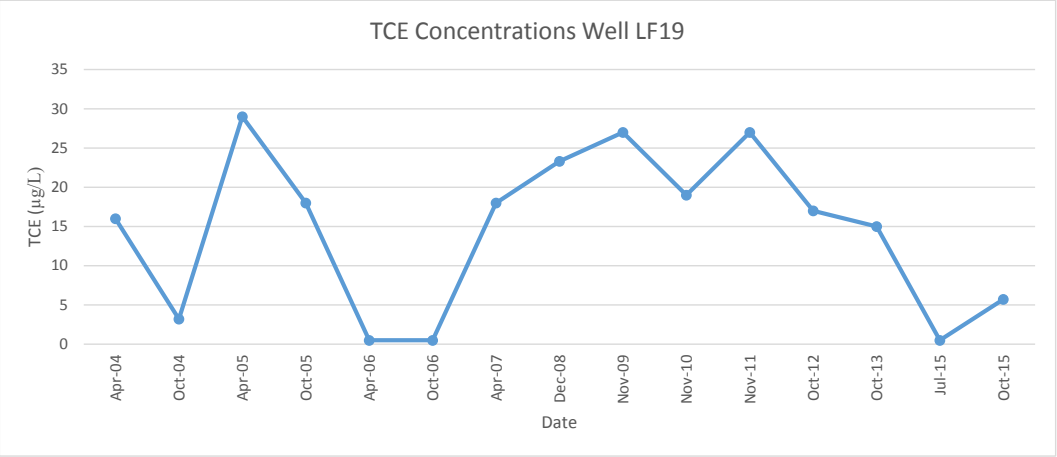
n	15
S	23
g	10
w	2
V(s)	228.3333
z	1.588278
Z(0.95)	1.64

Ho: No trend

Ha: upward trend

Reject Ho if z>Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	16
Oct-04	3.2
Apr-05	29
Oct-05	18
Apr-06	0.5
Oct-06	0.5
Apr-07	18
Dec-08	23.3
Nov-09	27
Nov-10	19
Nov-11	27
Oct-12	17
Oct-13	15
Jul-15	0.5
Oct-15	5.7

Mann-Kendall Test Using Normal Approximation for Larger Samples

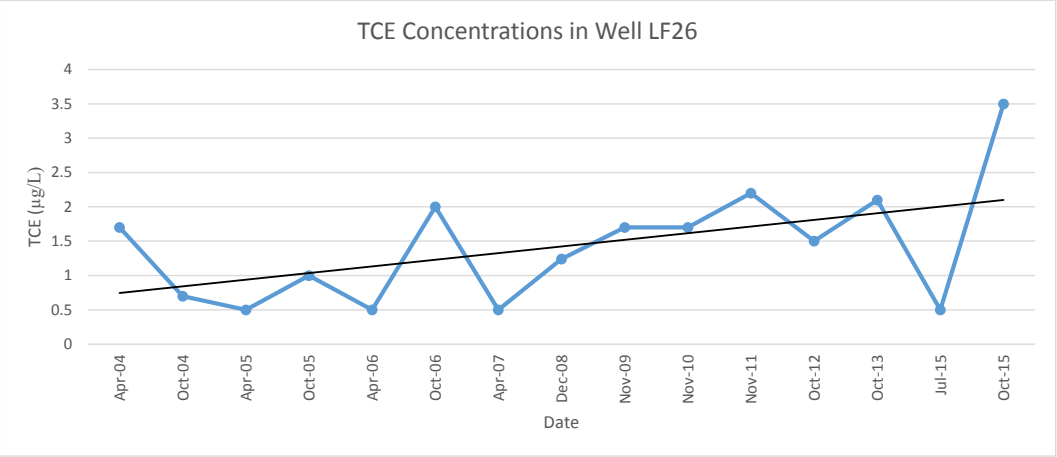
n	15
S	-8
g	5
w	2
V(s)	318.3333
z	-0.392335
Z(0.95)	-1.64

Ho: No trend

Ha: downward trend

Reject Ho if z<Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	1.7
Oct-04	0.7
Apr-05	0.5
Oct-05	1
Apr-06	0.5
Oct-06	2
Apr-07	0.5
Dec-08	1.24
Nov-09	1.7
Nov-10	1.7
Nov-11	2.2
Oct-12	1.5
Oct-13	2.1
Jul-15	0.5
Oct-15	3.5

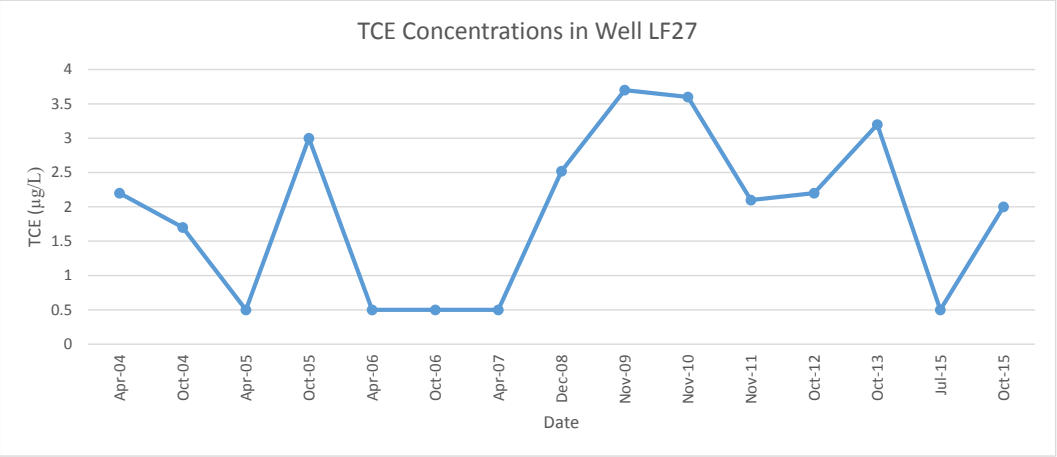
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	34
g	9
w	2
V(s)	246.3333
z	2.230008
Z(0.95)	1.64

Ho: No trend

Ha: upward trend

Reject Ho if z>Z(0.95) Ho is rejected, there is evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	2.2
Oct-04	1.7
Apr-05	0.5
Oct-05	3
Apr-06	0.5
Oct-06	0.5
Apr-07	0.5
Dec-08	2.52
Nov-09	3.7
Nov-10	3.6
Nov-11	2.1
Oct-12	2.2
Oct-13	3.2
Jul-15	0.5
Oct-15	2

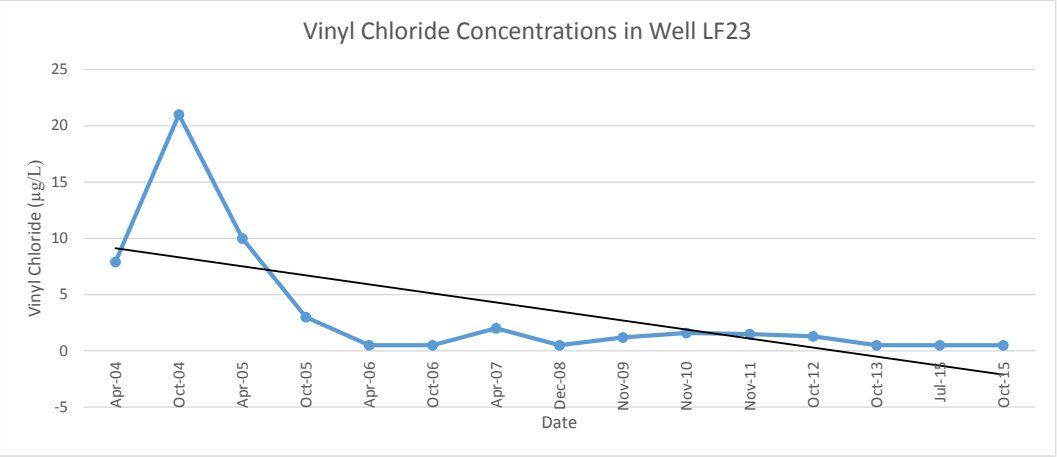
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	10
g	11
w	2
V(s)	210.3333
z	0.75847
Z(0.95)	1.64

Ho: No trend

Ha: upward trend

Reject Ho if z>Z(0.95) Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence



Date	µg/L
Apr-04	7.9
Oct-04	21
Apr-05	10
Oct-05	3
Apr-06	0.5
Oct-06	0.5
Apr-07	2
Dec-08	0.5
Nov-09	1.2
Nov-10	1.6
Nov-11	1.5
Oct-12	1.3
Oct-13	0.5
Jul-15	0.5
Oct-15	0.5

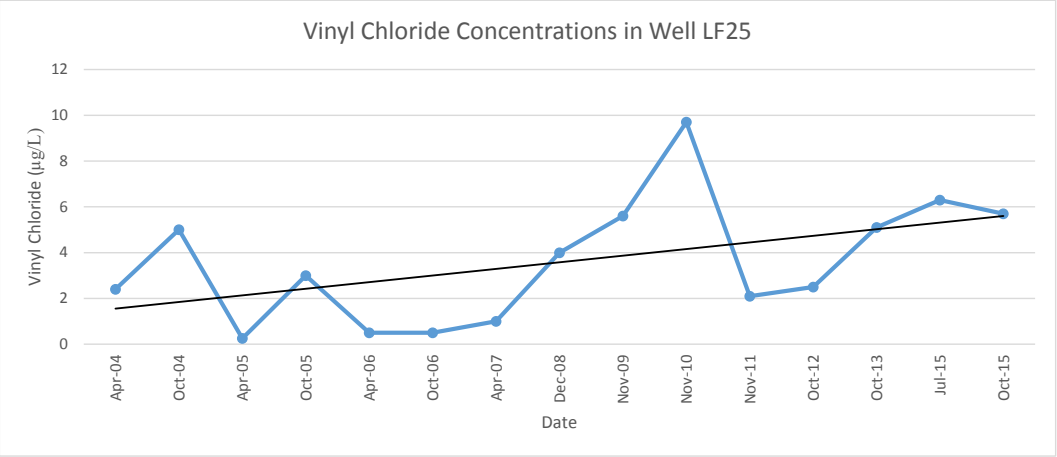
Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	-52
g	15
w	2
V(s)	138.3333
z	-4.336175
Z(0.95)	-1.64

Ho: No trend

Ha: Downward trend

Reject Ho if z<Z(0.95) Ho is rejected, there is evidence of a downward trend at the 95% level of confidence



Date	µg/L
Apr-04	2.4
Oct-04	5
Apr-05	0.25
Oct-05	3
Apr-06	0.5
Oct-06	0.5
Apr-07	1
Dec-08	4
Nov-09	5.6
Nov-10	9.7
Nov-11	2.1
Oct-12	2.5
Oct-13	5.1
Jul-15	6.3
Oct-15	5.7

Mann-Kendall Test Using Normal Approximation for Larger Samples

n	15
S	46
g	1
w	2
V(s)	390.3333
z	2.378921
Z(0.95)	1.64

Ho: No trend

Ha: Upward trend

Reject Ho if z>Z(0.95) Ho is rejected, there is evidence of an upward trend at the 95% level of confidence

ATTACHMENT 11
Institutional Controls

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AMSEL-TY-EL-E 18 December 2000

MEMORANDUM FOR RECORD

SUBJECT: Institutional Controls For Operable Unit (OU) 1 And OU 5

1. In September 1997 and September 2000 the Environmental Protection Agency and the Army signed Records of Decision (RODs) for two Operable Units located on Tobyhanna Army Depot. The RODs identified the remedial remedies for these sites. These sites are OU 1, Areas A and B, located in the non-industrial area near Family Housing and behind Building 702, respectively; and OU 5, the Inactive Sanitary Landfill. The remedy agreed to include Natural Attenuation, continued groundwater monitoring, and Institutional Controls. This memorandum provides procedures to accommodate one of the Institutional Controls, the restriction of any drinking water well construction at these sites.

2. The Directorate of Public Works will not allow the construction of any drinking water wells in the area of the Sanitary Landfill or Areas A and B. This restriction applies to the Real Property Installation Master Plan and also any other construction on the installation. A copy of this memo will become a permanent part of the Installation Real Property Master Plan. All construction on the depot is approved by the Chief of Engineering Division and/or the Director of Public Works. In addition, a Record of Environmental Consideration must be signed by the Chief of Environmental Management Division. Through these measures TYAD will assure compliance with the Institutional Control.

ROBERT K. THOMAS, P.E.
Master Planner

WILLIAM L. LEONARD, JR., P.E.
Chief, Engineering Division

JAMES D. SCOTT, P.E.
Director of Public Works

DEPARTMENT OF THE ARMY
TOBYHANNA army DEPOT
11 HAP ARNOLD BOULEVARD
TOBYHANNA, PENNSYLVANIA
18466-5086

Environmental Management Division

15 September 2000

Coolbaugh Township Zoning Officer
ATTN: Mr. Kenneth Monpalbin
5500 Memorial Boulevard
Tobyhanna, Pennsylvania 18466

Dear Mr. Monpalbin:

In May 1996 the Zoning Officer was requested to notify the depot should any new construction take place in the Village of Tobyhanna where the depot waterline has been extended. Residences along sections of Main and Maple Streets were provided depot water because of the ground water contamination present at that time. This requirement was agreed to by Tobyhanna Army Depot, the U.S. Environmental Protection Agency and the Pennsylvania Department of Environmental Protection. In addition, Restoration Advisory Board members (county/township representatives) concurred with this decision.

Continuing with the Installation Restoration Program we are currently completing a Record of Decision for the Inactive Sanitary Landfill. The Landfill borders Gouldsboro Road on the depots western side. Again the depot requests to be notified if any construction is planned along Gouldsboro Road in Coolbaugh Township. Notification can be made to either Mr. Kevin Toolan, Public Affairs Officer at 895-6552 or the undersigned.

If you have any questions regarding this request please call the undersigned at 895-6494.

Sincerely,

Craig H. Coffman
Installation Restoration
Program Manager

CF:
Mr. Stephens, EPA
Mr. Mellow, PADEP